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ABSTRACT

This document provides a common base for the K-9 (grades 10-12 are still under development) mathematics curriculum expectations mandated by the western Canadian provinces and territories of Manitoba, Saskatchewan, Alberta, British Columbia, Yukon Territory, and the Northwest Territories. The framework identifies beliefs about mathematics, general and specific student outcomes, and illustrative examples agreed upon by these six jurisdictions. The following aspects are discussed: (1) mathematical processes based on the standards of the National Council of Teachers of Mathematics: communication, connections, estimation and mental mathematics, problem solving, reasoning, technology, and visualization; (2) nature of mathematics: change, constancy, dimension, number, pattern, quantity, relationships, shape, and uncertainty; (3) strands: number, patterns and relations, shape and space, and statistics and probability; and (4) student expectations. The majority of the document contains general outcomes and specific outcomes with illustrative examples for each grade from kindergarten through grade 9. (MKR)

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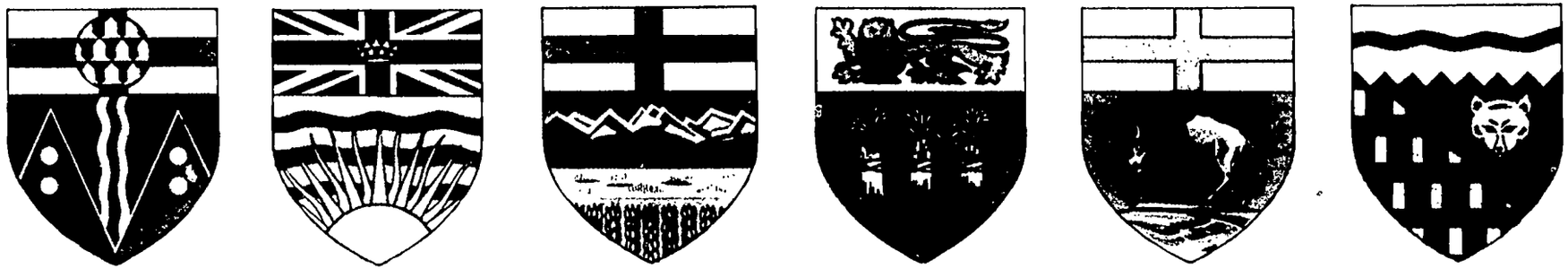

The Common Curriculum Framework

for

K-12 MATHEMATICS

(10 – 12 is under development)

Western Canadian Protocol for Collaboration in Basic Education

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I. BACKGROUND

Partners for Collaboration in Basic Education:

Manitoba
Saskatchewan
Alberta
British Columbia
Yukon Territory
Northwest Territories

The Western Canadian Protocol for Collaboration in Basic Education Kindergarten to Grade 12 was signed in December 1993 by the ministers of education from Manitoba, Saskatchewan, Alberta, British Columbia, Yukon Territory and the Northwest Territories. The protocol states that the four western provinces and the two territories agree to collaborate in basic education because of the importance they place on:

- common educational goals
- high standards in education
- removing obstacles for student access to educational opportunities, which includes improving the ease of transfer from jurisdiction to jurisdiction
- optimum use of educational resources.

The Common Curriculum Framework for K–12 Mathematics (The Common Framework) is the first in a series of joint development projects in basic education. It has been developed by the six ministries of education in collaboration with teachers, administrators, parents, business representatives, post-secondary instructors and others.

The Common Framework identifies beliefs about mathematics, general and specific student outcomes and illustrative examples agreed upon by the six jurisdictions. Each of the provinces and territories will determine when and how The Common Framework is to be implemented within its own jurisdiction.

II. INTRODUCTION

PURPOSE OF THE DOCUMENT

The Common Framework communicates high expectations for students.

The Common Framework addresses the major goals of the protocol. This document provides a common base for the curriculum expectations mandated by each province and territory. This common base will result in consistent student outcomes in mathematics across jurisdictions will enable easier transfer for students moving from one jurisdiction to another. Its intent is to **communicate clearly high expectations for students in mathematics education to all educational partners across the jurisdictions** and facilitate the development of common learning resources.

BELIEFS ABOUT STUDENTS AND MATHEMATICS LEARNING

Students are curious, active learners who have individual interests, abilities and needs. They come to classrooms with different knowledge, life experiences and backgrounds that generate a range of attitudes about mathematics and life.

Students must construct their own meaning of mathematics.

Students learn by attaching meaning to what they do; and they must be able to construct their own meaning of mathematics. This meaning is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract. The use of manipulatives can address the diversity of learning styles and developmental stages of students and can enhance the formation of sound, transferable, mathematical concepts. At all levels, students benefit from working with appropriate materials, tools and contexts when constructing personal meaning about new mathematical ideas. The learning environment should value and respect each student's way of thinking, so that the learner feels comfortable in taking intellectual risks, asking questions and posing conjectures.

Mathematics is a common human activity, increasing in importance in a rapidly advancing, technological society. A greater proficiency in using mathematics increases the opportunities available to individuals. Students need to become mathematically literate in order to explore problem-solving situations, accommodate changing conditions, and actively create new knowledge in striving for self-fulfillment.

GOALS FOR STUDENTS

Mathematics education must prepare students to use mathematics to solve problems.

The main goals of mathematics education are to prepare students to:

- use mathematics confidently to solve problems
- communicate and reason mathematically
- appreciate and value mathematics
- commit themselves to lifelong learning
- become mathematically literate adults, using mathematics to contribute to society.

At the completion of a program, students should have developed a positive attitude toward mathematics and have a base of knowledge and skills related to Number, Patterns and Relations, Shape and Space, and Statistics and Probability.

Positive attitudes toward mathematics are important.

It is important for students to develop a positive attitude toward mathematics so that they can become confident in their ability to undertake the problems of a changing world, thereby experiencing the power and usefulness of mathematics. Students also should gain an understanding and appreciation of the contributions of mathematics, as a science and as an art, to civilization and to culture.

Students should:

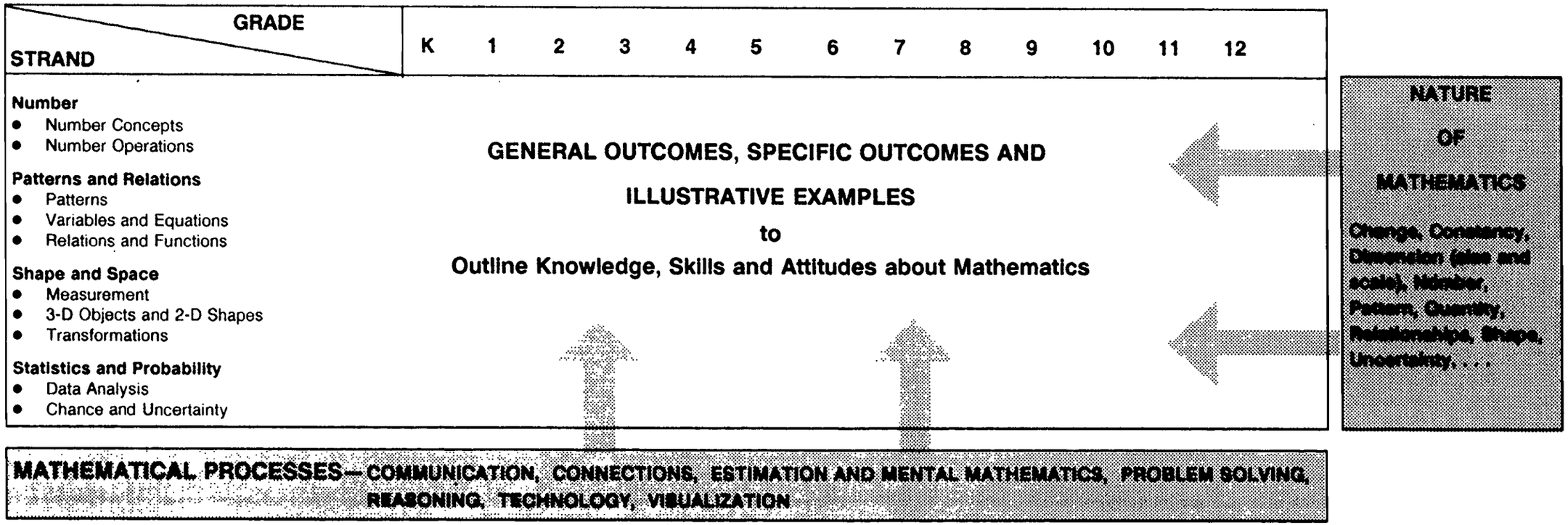
- exhibit a positive attitude toward mathematics
- engage and persevere in mathematical tasks and projects
- contribute to mathematical discussions
- take risks in performing mathematical tasks
- exhibit curiosity
- show some enjoyment of mathematical experiences.

All students should receive a level of mathematics education appropriate to their needs and abilities.

III. CONCEPTUAL FRAMEWORK FOR K–12 MATHEMATICS

Students of mathematics, regardless of age or experience, struggle to do mathematics in settings that are new to them. The conceptual framework outlined in this section presents a multifaceted view of mathematics and presents the discipline as skills, procedures and concepts woven together.

The framework chart below shows how student outcomes, organized by grade and strand, are designed to be influenced by Mathematical Processes and the Nature of Mathematics. These components are described more fully in this section.



MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and to encourage lifelong learning in mathematics. Students are expected to:

• *Communication*	• communicate mathematically
• *Connections*	• connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines
• *Estimation and Mental Mathematics*	• use estimation and mental mathematics where appropriate
• *Problem Solving*	• relate and apply new mathematical knowledge through problem solving
• *Reasoning*	• reason and justify their thinking
• *Technology*	• select and use appropriate technologies as tools to solve problems
• *Visualization*	• use visualization to assist in processing information, making connections and solving problems.

The Common Framework incorporates these seven interrelated mathematical processes that are intended to permeate teaching and learning.

Communication

Students need to communicate mathematical ideas clearly and effectively, orally and in writing.

Communication will help students make connections among different representations of mathematical ideas; namely, "physical, pictorial, graphic, symbolic, verbal and mental representations." (NCTM, p. 26)

Students must be able to communicate effectively how an answer was obtained.

It is not enough to arrive at an answer. Students must be able to communicate effectively how the answer was obtained. In other words, students need opportunities to read, to explore, to investigate, to write, to listen to, to discuss and to explain ideas in their own language of mathematics. Thus, students can create their own links "between their informal, intuitive notions and the abstract language and symbolism of mathematics." (NCTM, p. 26)

NCTM COMMUNICATION STANDARDS

K–4	5–8	9–12
The study of mathematics should include numerous opportunities for communication so that students can:	*The study of mathematics should include opportunities to communicate so that students can:*	*The mathematics curriculum should include the continued development of language and symbolism to communicate mathematical ideas so that all students can:*
• relate physical materials, pictures, and diagrams to mathematical ideas • reflect on and clarify their thinking about mathematical ideas and situations • relate their everyday language to mathematical language and symbols • realize that representing, discussing, reading, writing, and listening to mathematics are a vital part of learning and using mathematics.	• model situations using oral, written, concrete, pictorial, graphical, and algebraic methods • reflect on and clarify their own thinking about mathematical ideas and situations • develop common understandings of mathematical ideas, including the role of definitions • use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas • discuss mathematical ideas and make conjectures and convincing arguments • appreciate the value of mathematical notation and its role in the development of mathematical ideas.	• reflect upon and clarify their thinking about mathematical ideas and relationships • formulate mathematical definitions and express generalizations discovered through investigations • express mathematical ideas orally and in writing • read written presentations of mathematics with understanding • ask clarifying and extending questions related to mathematics they have read or heard about • appreciate the economy, power, and elegance of mathematical notation and its role in the development of mathematical ideas.
(NCTM, p. 26)	(NCTM, p. 78)	(NCTM, p. 140)

Connections

Through connections students should begin to view mathematics as an integrated whole.

Students need numerous and varied experiences in order to appreciate the usefulness of mathematics and, at the same time, to explore connections within mathematics, from mathematics to other disciplines, and from mathematics to their daily experiences. When mathematical ideas are connected to each other through concrete, pictorial and symbolic representations, students begin to view mathematics as an integrated whole.

This integration "allows students to see how one mathematical idea can help them understand others, and it illustrates the subject's usefulness in solving problems, describing and modeling real-world phenomena, and communicating complex thoughts and information in a concise and precise manner." (NCTM, p. 94)

NCTM CONNECTIONS STANDARDS

K–4	5–8	9–12
The study of mathematics should include opportunities to make connections so that students can:	*The mathematics curriculum should include the investigation of mathematical connections so that students can:*	*The mathematics curriculum should include investigation of the connections and interplay among various mathematical topics and their applications so that all students can:*
• link conceptual and procedural knowledge • relate various representations of concepts or procedures to one another • recognize relationships among different topics in mathematics • use mathematics in other curriculum areas • use mathematics in their daily lives.	• see mathematics as an integrated whole • explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations • use a mathematical idea to further their understanding of other mathematical ideas • apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, psychology, science, and business • value the role of mathematics in our culture and society.	• recognize equivalent representations of the same concept • relate procedures in one representation to procedures in an equivalent representation • use and value the connections among mathematical topics • use and value the connections between mathematics and other disciplines.
(NCTM, p. 32)	(NCTM, p. 84)	(NCTM, p. 146)

Estimation and Mental Mathematics

Mental mathematics is the cornerstone for estimation.

Students need to know when and how to estimate. The context of a problem helps to determine when it is necessary or desirable to have an exact answer or an estimate of that answer. Problem contexts include number, patterns and relations, shape and space, and statistics and probability. The use of technology increases the emphasis on estimation skills to enable students to determine the reasonableness of computed answers.

A variety of estimation strategies assists students in arriving at quick approximations for exact answers.

Facility with mental mathematics is an important outcome for students. A focus on mental mathematics forces students to think and improve their efficiency and accuracy in calculating, including pencil and paper calculations. Mental mathematics is the cornerstone for estimation and leads to better understanding of number concepts and number operations. (Hope, pp. 161–173)

Problem Solving

"Problem-solving—which includes the ways in which problems are represented, the meanings of the language of mathematics, and the ways in which one conjectures and reasons—must be central to schooling so that students can explore, create, accommodate to changed conditions, and actively create new knowledge over the course of their lives." (NCTM, p. 4)

Problem solving is the focus of mathematics at all grade levels.

Problem solving is the focus of mathematics at all grade levels. The development of each student's ability to solve problems is essential. Students develop a true understanding of mathematical concepts and procedures when they solve problems in meaningful contexts. Problem solving is to be employed throughout all of mathematics and should be embedded throughout all of the strands.

Problem solving provides an opportunity for students to be active in constructing mathematical meaning, to learn problem-solving strategies, to practise a variety of concepts and skills in a meaningful context, and to communicate mathematical ideas. Most problem-solving situations in the elementary years come from the everyday experiences of the student. Students are able to attach mathematical meaning to familiar activities. As they progress through school, the problems become more complex. The problems will arise from an exploration of mathematics itself, as well as from the world around them. Gradually, students become more confident in their ability to use and communicate mathematics, using correct terminology.

As students develop mathematically, they are able to solve more challenging problems on an increasing variety of topics. Students need the opportunity "to solve problems that require them to work cooperatively (and individually), to use technology, to address relevant and interesting mathematical ideas, and to experience the power and usefulness of mathematics." (NCTM, pp. 75–76) By the time students reach the secondary level, many problem-solving strategies should be internalized and problem solving should be a process for constructing and reinforcing mathematical concepts.

Students should be confident and flexible problem solvers, using a wide range of strategies in their work, and accept that some problems have different solutions.

NCTM PROBLEM-SOLVING STANDARDS

K–4	5–8	9–12
The study of mathematics should emphasize problem solving so that students can:	*The mathematics curriculum should include numerous and varied experiences with problem solving as a method of inquiry and application so that students can:*	*The mathematics curriculum should include the refinement and extension of methods of mathematical problem solving so that all students can:*
• use problem-solving approaches to investigate and understand mathematical content • formulate problems from everyday and mathematical situations • develop and apply strategies to solve a wide variety of problems • verify and interpret results with respect to the original problem • acquire confidence in using mathematics meaningfully.	• use problem-solving approaches to investigate and understand mathematical content • formulate problems from situations within and outside mathematics • develop and apply a variety of strategies to solve problems, with emphasis on multistep and nonroutine problems • verify and interpret results with respect to the original problem situation • generalize solutions and strategies to new problem situations • acquire confidence in using mathematics meaningfully.	• use, with increasing confidence, problem-solving approaches to investigate and understand mathematical content • apply integrated mathematical problem-solving strategies to solve problems from within and outside mathematics • recognize and formulate problems from situations within and outside mathematics • apply the process of mathematical modeling to real-world problem situations.
(NCTM, p. 23)	(NCTM, p. 75)	(NCTM, p. 137)

Reasoning

Reasoning helps students to make sense of mathematics and to be logical in their thinking.

Students need to develop confidence in their ability to reason and to justify their thinking within and outside of mathematics. The power of reasoning helps students to make sense of mathematics, to be logical in their thinking, and to convince others.

Inductive reasoning helps students explore and make conjectures from activities that allow generalizations from a pattern of observations.

Deductive reasoning helps students test conjectures and build arguments that serve to validate thinking. Deductive reasoning builds a structured body of knowledge.

NCTM REASONING STANDARDS

K–4	5–8	9–12
The study of mathematics should emphasize reasoning so that students can:	*Reasoning shall permeate the mathematics curriculum so that students can:*	*The mathematics curriculum should include numerous and varied experiences that reinforce and extend logical reasoning skills so that all students can:*
• draw logical conclusions about mathematics • use models, known facts, properties, and relationships to explain their thinking • justify their answers and solution processes • use patterns and relationships to analyze mathematical situations • believe that mathematics makes sense.	• recognize and apply deductive and inductive reasoning • understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs • make and evaluate mathematical conjectures and arguments • validate their own thinking • appreciate the pervasive use and power of reasoning as a part of mathematics.	• make and test conjectures • formulate counterexamples • follow logical arguments • judge the validity of arguments • construct simple valid arguments.
(NCTM, p. 29)	(NCTM, p. 81)	(NCTM, p. 143)

Technology

Technology will aid students in solving complex problems.

Improvements in technology, and its increased availability in schools, have changed the focus of mathematics education. The time saved by using calculators or computers to perform complex calculations can be used to help students better understand mathematical concepts. Students can then understand the relationships among concepts and use these relationships to solve problems.

Calculators and computers can be used as tools to:

- develop concepts
- explore and demonstrate mathematical relationships and patterns
- organize and display data
- assist with solving problems and thus promote independence
- encourage students to be inquisitive and creative
- decrease the time spent on tedious computations
- reinforce the learning of basic number facts and properties
- develop an understanding of computational algorithms
- create geometric displays
- simulate situations.

In some cases, technology will allow teachers to ask questions requiring a high level of thinking and will allow students to solve complex, multifaceted problems. Technology can foster environments in which the growing curiosity of students can lead to rich mathematical discoveries. In these environments, the control of exploring mathematical ideas can be turned over to students.

Visualization

Images are useful in describing the physical and mathematical environment.

Visualization "involves thinking in *pictures* and *images* and the ability to perceive, transform and re-create different aspects of the visual–spatial world." (Armstrong, p. 10, italics in original) The use of images in the study of mathematics provides students with the opportunity to understand mathematical concepts and to make connections among them.

The physical environment is full of images. The images are of 3-D objects, 2-D shapes, 1-D lines and pictures. In geometry, the study of a 3-D object is assisted by visualizing either the net of 2-D shapes or the skeleton of 1-D lines required to construct the object.

The mathematical environment is full of images. These images are used to communicate mathematical concepts and multiple solutions to problems. At an elementary level, four piles, each containing three coins, can be used to represent $3+3+3+3=12$. Rearranging the piles into four rows of 3 can then be used to represent $4\times3=12$. Connecting the two images links the process of multiplication with that of repeated addition. At a more advanced level, analytic geometry describes figures algebraically and provides a tool for the visualization of algebraic relations. The analysis and interpretation of data using a visual summary aids in understanding the data and making predictions from it.

NATURE OF MATHEMATICS

- *Change*
- *Constancy*
- *Dimension*
- *Number*
- *Pattern*
- *Quantity*
- *Relationships*
- *Shape*
- *Uncertainty*

By enriching our view of mathematics and the learning environment, the outcomes of The Common Framework can be accomplished.

The brain is constantly looking for and making connections. "Because the learner is constantly searching for connections on many levels, educators need to orchestrate the experiences from which learners extract understanding. . . . Brain research establishes and confirms that multiple complex and concrete experiences are essential for meaningful learning and teaching." (Caine, p. 5)

There are additional critical components that must be addressed in a mathematics program beyond those listed as mathematical processes. The components discussed are: Pattern, Number, Shape, Change, Constancy, Dimension (size and scale), Relationships, Quantity and Uncertainty. They are used to describe mathematics in a broad way in order to establish the wide variety of connections that can be made among the various strands used to organize the outcomes central to The Common Framework.

Change

Change is a very broad concept. Students must become sensitive to patterns, such as linear, exponential, logarithmic and periodic.

Change can be discussed from Kindergarten to Grade 12 across many aspects of mathematics. The study of change is often discussed in the context of calculus, but is often limited to this context. However, change is a much broader concept than that used in calculus. In order to make predictions, students need to describe and quantify their observations, attempt to build patterns, and identify those quantities that remain fixed and those quantities that change. For example, look at the pattern 4, 6, 8, 10, 12, . . . An elementary school student can describe this as skip counting by 2s, starting from 4. A senior high school student may describe this pattern as an arithmetic sequence, with first term 4, and a common difference of 2. Another student may describe it as a linear function with a discrete domain. All three interpretations are focusing on the changing size of the numbers within the sequence. To be able to understand change, students must become sensitive to patterns, such as linear, exponential, logarithmic and periodic. (Steen, p. 184)

Constancy

Constancy is described by the terms stability, conservation, equilibrium, steady state and symmetry.

Students are expected to communicate ideas visually, using diagrams and oral and written words, when describing constancy or invariance. Different aspects of constancy "are described by the terms stability, conservation, equilibrium, steady state, and symmetry." (AAAS–Benchmarks, p. 270) The most important properties in mathematics and science relate to those properties that do not change when outside conditions change. Elementary school students deal with constancy in situations where different methods are used to solve a single multiplication problem, such as finding the area of a 3-tile by 4-tile tabletop. Secondary students need to deal with constancy when they solve the more complicated multiplication problems that appear in determining the number of elements present in the sample spaces of probability problems. Many of these situations will involve permutations and combinations.

In geometry, a circle can be transformed into an ellipse by a simple stretch, and into a square by a more complex series of transformations; but there is no way that the circle can be transformed into a parabola. The closed figures, such as circles and squares, remain closed and cannot be transformed into open figures, such as parabolas. Triangles can be distorted in many ways, but all will have an angle sum of 180°. The straight line is characterized as having all its parts with the same slope. In solving many of the most important problems in mathematics, students need to concentrate on the properties that remain constant. This idea enables students to solve problems involving constant rates of change, lines with constant slope, direct variation situations, or the angle sums of polygons.

Dimension (size and scale)

The concept of dimension needs to be developed within an environment of physical objects.

The concept of dimension, most usually associated with 3-D objects, 2-D figures or 1-D lines, needs to be developed within an environment of physical objects for all grades from Kindergarten to Grade 12. The prediction of the change in dimension of objects can be done using numbers attached to appropriate units. For example, with no knowledge of a formula, students in upper elementary grades can predict that doubling the side of a square generates four times the area. Junior and senior high school students need to be able to use algebraic structures to formalize this relationship.

Physical objects can all be described using measurement concepts. The development of perimeter, area and volume concepts relies on pattern recognition, not on memorization of formulas. Descriptions of geometric patterns (number of vertices, sides and edges of various 3-D objects, 2-D figures and 1-D lines); and the angle sum of various 2-D figures is also encouraged. This type of data should be placed in charts and/or graphs to help students visualize their findings and predict patterns.

Number

The use of number must include number sense.

Number, number systems and the operations on numbers are vital to all mathematics learning. The use of number must go beyond procedure and accuracy to include what is called **number sense**. Number sense includes:

- an intuitive feeling about numbers and their multiple relationships
- construction of the meaning of number through a variety of experiences, and development of an appreciation of the need for numbers beyond whole numbers (NCTM, p. 38)
- an appreciation and ability to make quick order of magnitude approximations (Steen, p. 79) with emphasis on establishing quick and accurate estimations for computation and measurement
- the ability to detect arithmetic errors
- knowledge of place value and the effects of arithmetic operations.

Many numerical calculations are performed with calculators and computers, and students must be able to determine if the desired calculations have been done correctly. Students must plan for the efficient use of technological tools.

Number patterns should be recognized and used to count, to make predictions, to describe shapes and to compare.

Pattern

Mathematics is an exploratory science that seeks to understand every kind of pattern.

"What humans do with the language of mathematics is to describe patterns. Mathematics is an exploratory science that seeks to understand every kind of pattern. . . ." (Steen, p. 8) Patterns exist in number, geometry, algebra and data. By helping students recognize, extend, create and use patterns as a routine aspect of their lives, mathematics will become a useful tool to assist them in their systematic and intellectual understanding of their environment.

Quantity

Quantitatively literate people use numbers to describe phenomena in all aspects of mathematics.

"Quantitatively literate young need a flexible ability to identify critical relations in novel situations, to express these relations in effective symbolic form, to use computing tools to process information, and to interpret the results of those calculations."
(Steen, p. 65)

Students have a strong desire to measure, code and order things. To this end, some of the outcomes are about single numbers, numbers attached to units of measure, and ordered sets of numbers. Other outcomes are about the interpretation of numbers and of number systems. The use of single numbers and of ordered pairs to describe phenomena in all aspects of mathematics, the natural sciences and the social sciences is very important.

With the growing use of technology to process numerical information, it is becoming essential for students to have a wide range of estimation skills so that they can evaluate whether or not the numerical output provided by a calculator or a computer is a reasonable solution to a given problem.

Relationships

The study of mathematics is the development of relationships between and among things.

The study of mathematics is the development of relationships between and among things. Part of mathematics should help students develop a sense of discovery that mathematicians over the years have felt and should prepare the way for students to make their own discoveries. Students should look for relationships among physical things, as well as the data used to describe those things. Descriptions of the attributes of objects are used to analyze symmetry and congruence and to classify things, using increasingly sophisticated language. Relationships will be described visually, symbolically, orally and in written form.

Shape

Shape in mathematics includes geometric representations of algebraic relations, the geometry of maps and the creation of networks of figures.

Shape in mathematics is central to geometry but also includes geometric representations of algebraic relations, the geometry of maps and the creation of networks of plane figures that can be used to construct 3-D objects. It is very important for students to look for and use similarities, congruences, patterns, transformations, dilatations and tessellations in the solution of a range of problems.

The use of language to describe shapes is an important aspect of mathematics. This description allows for the classification of objects according to various attributes, the naming of objects, and the analysis of objects. The study of shape can be used to build a deductive system, which can assist in further, more detailed analysis. Shape is used in the development of visual models in other disciplines, such as the use of molecular models in chemistry and biology.

The use of technology to analyze and depict shape will increase in importance for students of mathematics as more and better software and hardware become available in classrooms.

Uncertainty

Uncertainty involves data, chance, measurements and errors.

Uncertainty involves data, chance, measurements and errors. Problems dealing with data, together with numbers in context found in the mass media, can be solved within the school mathematics program so long as the data provided and the problems posed have some meaning and relevance to students.

Chance deals with the predictable and the unpredictable outcomes of events. Students from an early age are expected to deal with the concept of chance. As they mature, the language they use to describe chance becomes more sophisticated and involves the vocabulary of probability theory.

When dealing with random events and complex experiments, students can generate large quantities of data requiring analysis. The use of various technologies enables the student to summarize data easily and to create a visualization of the data to help identify patterns in the information. In some instances the functions describing patterns are linear, periodic, logarithmic or exponential, and senior high school students are expected to use the appropriate algebraic structures to model the information contained within the pattern.

The quality of the output information is directly related to the quality of the input data. The study of uncertainty allows students to assess the reliability of input data, and to learn the processes whereby input data is converted to output information.

STRANDS

- *Number*
- *Patterns and Relations*
- *Shape and Space*
- *Statistics and Probability*

The student outcomes are organized within four strands. The strands are the formal aspects of the discipline of mathematics that form the foundation of The Common Framework and act as connections across the grades. Four strands have been identified for the entire Kindergarten to Grade 12 mathematics framework to reinforce the interrelationship of mathematical concepts and skills. These strands are split into substrands. However, any such grouping into strands and substrands is for organizational purposes only, and does not reflect the connections among the strands and the underlying themes running throughout all of mathematics.

Number

Number Concepts

Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

Number Operations

Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

Patterns and Relations

Patterns

Students will:
- use patterns to describe the world and to solve problems.

Variables and Equations

Students will:
- represent algebraic expressions in multiple ways.

Relations and Functions [will apply to Grades 10–12]

Students will:
- use algebraic and graphical models to generalize patterns, make predictions and solve problems.

Shape and Space

Measurement

Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

3-D Objects and 2-D Shapes

Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

Transformations

Students will:
- perform, analyze and create transformations.

Statistics and Probability

Data Analysis

Students will:
- collect, display and analyze data to make predictions about a population.

Chance and Uncertainty

Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

STUDENT EXPECTATIONS

The content of The Common Framework is stated in terms of outcomes. These outcomes are measurable and identify what students are required to know and do.

The outcomes are developed grade by grade from Kindergarten to Grade 12 and are based on the expectation that they are appropriate to a large majority of the students. They are stated at the grade where they are expected to be "mastered". There may be some time delays between where students first encounter the learning and where they are expected to demonstrate knowledge of, or mastery in, that learning.

General Outcomes

General outcomes are general statements that identify what students are expected to know and to be able to do upon completion of a grade.

Specific Outcomes

Specific outcomes are statements identifying the component knowledge, skills and attitudes of a general outcome.

Illustrative Examples

Illustrative examples are sample tasks that demonstrate and elaborate on the general and specific outcomes. They are important in conveying the richness, breadth and depth intended in the outcomes.

SUMMARY

The components of the Conceptual Framework for K–12 mathematics, as described, dictate what should be happening in mathematics education. The components are not meant to stand alone, but are to be interrelated to enhance one another. Activities that take place in the classroom should stem from a problem-solving approach built on the mathematical processes and lead students to an understanding of the nature of mathematics through specific knowledge, skills and attitudes related to each of the strands.

Student expectations are described in terms of:

- *general outcomes*
- *specific outcomes*
- *illustrative examples.*

IV. INSTRUCTIONAL FOCUS

SUGGESTED TIME ALLOTMENTS

The Common Framework is arranged into four strands, each of significance. Therefore, considerable time should be spent on the concepts and processes identified in each strand. The following chart outlines suggested time allotments.

Strand	K–4	5–9	10–12
Number	25–35%	25–35%	To Be Announced
Patterns and Relations	15–25%	20–30%	
Shape and Space	25–35%	20–30%	
Statistics and Probability	15–25%	15–25%	

Along with the time recommendations for each strand, several additional considerations are important:

- Integration of the mathematical processes, within each strand, is encouraged and expected.
- By decreasing emphasis on rote calculation, drill and practice, and the size of numbers used in paper and pencil calculations, more time is available for concept development.
- Problem solving , reasoning and connections are vital to increasing mathematical power and must be integrated throughout the program. A minimum of half the available time within all strands needs to be dedicated to activities related to these processes.
- There is to be a balance between estimation and mental mathematics, paper and pencil exercises and the appropriate use of technology, including calculators and computers. Concepts should be introduced, using manipulatives, and gradually developed from the concrete to the pictorial to the symbolic.

V. STUDENT OUTCOMES

The body of this section of the document is divided into three sections, each of which serves a different but cumulative purpose.

The general outcomes for Grade 10 to Grade 12 have a grey **background** to indicate their "in-review" status. The specific outcomes and illustrative examples for Grade 10 to Grade 12 are to be developed at a later date.

GENERAL OUTCOMES (pages 20–27)

This section presents the general outcomes of The Common Framework, for each strand, Kindergarten through Grade 12, to show the direction and scope of the total curriculum.

GENERAL OUTCOMES AND SPECIFIC OUTCOMES (pages 28–59)

This section presents the general and specific outcomes together, for each strand, Kindergarten through Grade 9. This grouping shows the relationships between the general outcomes and the specific outcomes.

GENERAL OUTCOMES, AND SPECIFIC OUTCOMES WITH ILLUSTRATIVE EXAMPLES (pages 61–288)

This section adds sample tasks to the general and specific outcomes, and is organized by strand, within a grade. Most of these examples add clarity about the intended depth and breadth of the specific outcomes. A few illustrated examples are designed to convey the intended depth of a general outcome. Some outcomes are sufficiently clear that illustrative examples are unnecessary.

GENERAL OUTCOMES—Number Strand

Substrand	K	1	2	3	4	5
Number Concepts *Students will:* • use numbers to describe quantities • represent numbers in multiple ways.	Describe, orally, and compare quantities from 0 to 10, using number words in daily experiences.	Recognize and apply whole numbers from 0 to 100, and explore halves, in familiar settings.	Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths).	Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions.	Demonstrate a number sense for whole numbers, 0 to 100 000, and explore proper fractions and decimals.
Number Operations *Students will:* • demonstrate an understanding of and proficiency with calculations • decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.	Demonstrate awareness of addition and subtraction.	Apply informal methods of addition and subtraction on whole numbers where the maximum sum is 18.	Apply a variety of addition and subtraction strategies on whole numbers to 100, and use these operations in solving problems. Use an appropriate calculation strategy or technology to solve problems.	Apply an arithmetic operation (addition, subtraction, multiplication or division) on whole numbers, and illustrate its use in creating and solving problems. Use and justify appropriate calculation strategy or technology to solve problems.	Apply arithmetic operations on whole numbers, and illustrate their use in creating and solving problems. Use and justify an appropriate calculation strategy or technology to solve problems. Demonstrate an understanding of addition and subtraction of decimals.	Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.

6	7	8	9	10–12		
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers	Demonstrate a number sense for decimals and integers, including whole numbers.	Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.	Explain and illustrate the structure and the interrelationship of the sets of numbers within the rational number system. Develop a number sense of powers with integral exponents and rational bases.	Explain and illustrate the structure and the interrelationship of the sets of numbers within a number system.	Describe and apply arrays in the formulation and solution of problems.	Describe, apply and transform arrays in the formulation and solution of problems.
Apply arithmetic operations on whole numbers and decimals in solving problems.	Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems. Illustrate the use of rates, ratios, percentages and decimals in solving problems.	Apply arithmetic operations on rational numbers to solve problems. Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.	Use a scientific calculator or a computer to solve problems involving rational numbers. Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.	Apply the basic operations, singly or in combination, (and their interrelationship) on any real number, and illustrate the use of these operations in solving practical problems, such as budgeting.	Describe and apply operations on arrays to solve problems, using spreadsheet technology as required.	Describe and apply operations and transformations on arrays to solve problems, using spreadsheet technology as required.

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GENERAL OUTCOMES—Patterns and Relations Strand

Substrand	K	1	2	3	4	5
Patterns *Students will:* • use patterns to describe the world and to solve problems.	Identify and create patterns arising from daily experiences.	Identify, create and compare patterns arising from daily experiences in the classroom.	Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.	Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions.	Investigate, establish and communicate rules for, and predictions from, numerical and non-numerical patterns, including those found in the community.	Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.
Variables and Equations *Students will:* • represent algebraic expressions in multiple ways.						
Relations and Functions *Students will:* • use algebraic and graphical models to generalize patterns, make predictions and solve problems.						

6	7	8	9	10–12		
Use relationships to summarize, generalize and extend patterns, including those found in music and art.	Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.	Use patterns, variables and expressions, together with their graphs, to solve problems.	Generalize, design and justify mathematical procedures, using appropriate patterns, models and technology.	**Represent by models, naturally-occurring data, using linear and nonlinear functions.**	**Represent by models, those situations involving natural growth and decay.**	**Represent by models, naturally-occurring data that are cyclical in character.**
Use informal and concrete representations of equality and operations on equality to solve problems.	Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.	Solve and verify one-step and two-step linear equations with rational number solutions.	Solve and verify linear equations and inequalities in one variable. Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	**Represent and analyse situations that involve variables, expressions, equations and inequations**	**Connect and analyze functions and their graphs to solve problems.**	**Translate between algebraic and coordinate relationships and the corresponding geometric shapes to solve problems.**
				Translate between the various representations of discrete and continuous functions.	**Link models involving natural growth and decay to the exponential function.**	**Link models involving data of a cyclical character to trigonometric functions.**

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GENERAL OUTCOMES—Shape and Space Strand

Substrand	K	1	2	3	4	5
Measurement *Students will:* • describe and compare everyday phenomena, using either direct or indirect measurement.	Demonstrate awareness of measurement.	Estimate, measure and compare, using whole numbers and nonstandard units of measure.	Estimate, measure and compare, using standard units for length and primarily nonstandard units for other measures.	Estimate, measure and compare, using whole numbers and primarily standard units of measure.	Estimate, measure and compare, using decimal numbers and standard units of measure.	Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.
3-D Objects and 2-D Shapes *Students will:* • describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	Sort, classify and build real-world objects.	Explore and classify 3-D objects and 2-D shapes, according to their properties.	Name, describe and construct a variety of 3-D objects and 2-D shapes.	Describe, classify, construct and relate 3-D objects and 2-D shapes.	Describe, classify, construct and relate 3-D objects and 2-D shapes, using mathematical vocabulary.	Use visualization of 3-D objects and 2-D shapes to solve problems related to spatial relations.
Transformations *Students will:* • perform, analyze and create transformations.	Describe, orally, the position of 3-D objects.	Describe, orally, the relative position of 3-D objects and 2-D shapes.	Apply positional language, orally and in writing, to communicate motion.	Use numbers and direction words to describe the relative positions of objects in one dimension, using everyday contexts.	Use numbers and direction words to describe the relative positions of objects in two dimensions, using everyday contexts.	Describe motion in terms of a slide, a turn or a flip. Use coordinates to describe the positions of objects in two dimensions.

6	7	8	9	10–12	
Solve problems involving perimeter, area, surface area, volume and angle measurement.	Solve problems involving the properties of circles and their connections with angles and time zones.	Apply indirect measurement procedures to solve problems. Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.	Use trigonometric ratios to solve problems involving a right triangle. Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.	Solve problems, using modern measuring devices, such as electronic tuning forks, calipers, micrometers, electronic tape measures, instrument–computer interfaces. Use the special properties of right triangles, including the sine, cosine and tangent ratios, to solve problems involving more than one right triangle. Design an object to satisfy constraints, such as maximum or minimum.	Investigate the combination of vector quantities. Apply the sine and cosine laws to solve practical problems involving general triangles.
Use visualization and symmetry to solve problems involving classification and sketching.	Link angle measures to the properties of parallel lines.	Link angle measures and the properties of parallel lines to the classification and properties of quadrilaterals.	Specify conditions under which triangles may be similar or congruent, and use these conditions to solve problems. Use spatial problem solving in building, describing and analyzing geometric shapes.	Justify congruence and similarity, using transformations and coordinate geometry.	Derive the properties relating chords, tangents, arcs and angles in circular and spherical geometry. Make and justify conjectures regarding the properties of a set of related figures.
Create patterns and designs that incorporate symmetry, tessellations, translations and reflections.	Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.	Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.	Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes.	Apply coordinate geometry and pattern recognition to predict the effects of combinations of transformations on 1-D lines and 2-D shapes.	Represent transformations numerically.

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GENERAL OUTCOMES—Statistics and Probability Strand

Substrand	K	1	2	3	4	5
Data Analysis *Students will:* • collect, display and analyze data to make predictions about a population.	Collect and organize, with assistance, data based on first-hand information.	Collect, organize and describe, with guidance, data based on first-hand information.	Collect, display and describe data, independently, based on first-hand information.	Collect first- and second-hand data, display the results in more than one way, and interpret the data to make predictions.	Collect first- and second-hand data, assess and validate the collection process, and graph the data.	Develop and implement a plan for the collection, display and interpretation of data to answer a question.
Chance and Uncertainty *Students will:* • use experimental or theoretical probability to represent and solve problems involving uncertainty.		Describe concepts of chance and chance events, using ordinary vocabulary.	Use simple experiments, designed by others, to illustrate chance.	Use simple probability experiments, designed by others, to explain outcomes.	Design and use simple probability experiments to explain outcomes.	Predict outcomes, conduct experiments and communicate the probability of single events.

6	7	8	9	10–12		
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.	Develop and implement a plan for the collection, display and analysis of data, using technology, as required. Evaluate and use measures of central tendency and variability.	Collect and analyze experimental results expressed in two variables, using technology, as required.	Describe, implement and analyze sampling procedures, and draw appropriate inferences from the data collected. Apply curve-fitting and correlation techniques to analyze experimental results.	Apply curve-straightening and correlation techniques to analyze experimental results.	Analyze discrete and continuous data distributions to produce descriptions and inferences about populations and samples.
Use numbers to communicate the probability of single events from experiments and models.	Create and solve problems, using probability.	Compare theoretical and experimental probability of independent events.	Explain the use of probability and statistics in the solution of complex problems.	Use expected gains and losses to make and analyze decisions based on a single event.	Model the probability of a compound event, using the probability of simple events, and use probability models to solve problems involving uncertainties.	Solve problems based on the counting of sets or the combining of simpler probabilities.

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Strand: Number (Number Concepts)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Describe, orally, and compare quantities from 0 to 10, using number words in daily experiences. **Specific Outcomes** 1. Count the number of objects in a set (0 to 10). [CN, V] 2 Build and compare sets of objects and describe the relationships among them, using the terms; more than, greater than, fewer than, less than, the same as and equal to (no written symbols). [C] 3 Order up to 2 sets of like objects based on the number of objects in each set. [PS] 4. Explore the representation of single-digit numerals, using a calculator or a computer to represent numerals on a screen. [PS, R, T]	**General Outcome** Recognize and apply whole numbers from 0 to 100, and explore halves, in familiar settings. **Specific Outcomes** 1. Count orally by 1s, 2s, 5s and 10s to 100. [C, CN] 2. Estimate, then count the number of objects in a set (0 to 50) and compare the estimate with the actual number. [C, E, T] 3. Recognize, build, compare and order sets that contain 0 to 50 elements. [V] 4. Read number words to 10. [C] 5. Represent and describe numbers to 50 in a variety of ways. [C, PS, R, V] 6. Explore the representation of numerals (0 to 50), using a calculator or a computer to display numerals. [PS, R, T] 7. Demonstrate, and explain orally, an understanding of halves as part of a shape or solid. [C, CN, V]	**General Outcome** Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters). **Specific Outcomes** 1. Count to 1000 by 1s, 2s, 5s and 10s, and to 100 by 25s, using starting points that are multiples of 1, 2, 5, 10 and 25 respectively. [C, CN] 2. Estimate, then count the number of objects in a set (0 to 100), and compare the estimate with the actual number. [C, E, PS, R] 3. Recognize, build, compare and order sets that contain 0 to 100 elements. [V] 4. Represent and describe numbers to 100 in a variety of ways. [C, PS, R, V] 5. Demonstrate, concretely and pictorially, place value concepts to give meaning to numbers up to 100. [C, R, V] 6. Round numbers to the nearest ten. [E] 7. Read and write numerals to 100. [C, CN] 8. Read and write number words to 20. [C, CN, V] *(continued on p. 30)*	**General Outcome** Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths). **Specific Outcomes** 1. Count by 2s, 5s, 10s and 100s to 1000, using random starting points. [CN] 2. Count by 25s to 1000, using starting points that are multiples of 25. [C, CN] 3. Estimate, then count the number of objects in a set (0 to 1000), and compare the estimate with the actual number. [C, E] 4. Skip count backward by 2s, 5s, 10s and 100s, using starting points that are multiples of 2, 5, 10 and 100 respectively. [C, CN, T] 5. Demonstrate, concretely and pictorially, place value concepts to give meaning to numbers up to 1000. [C, R, V] 6. Recognize, build, compare and order sets that contain 0 to 1000 elements. [PS, R, V] 7. Round numbers to the nearest hundred. [E] *(continued on p. 30)*	**General Outcome** Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions. **Specific Outcomes** 1. Estimate, then count the number of objects in a set (0 to 1000), and compare the estimate with the actual number. [C, E] 2. Use skip counting (forward and backward) to support an understanding of patterns in multiplication and division. [C, CN] 3. Read and write numerals to 10 000. [R, V] 4. Read and write number words to 1000. [C, CN] 5. Compare and order whole numbers up to 10 000. [C] 6. Demonstrate concretely, pictorially and symbolically place value concepts to give meaning to numbers up to 10 000. [C, R, T, V] 7. Represent and describe numbers to 10 000 in a variety of ways. [C, PS, R, V] 8. Round numbers to the nearest thousand. [E] *(continued on p. 30)*	**General Outcome** Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals. **Specific Outcomes** 1. Demonstrate, concretely and pictorially, an understanding of place value from hundredths. [C, R ,V] 2. Read and write numerals to 100 000. [C, CN] 3. Read and write number words to 100 000. [C, CN, V] 4. Use estimation strategies for quantities up to 100 000. [E] 5. Recognize, model and describe multiples, factors, composites and primes. [C, R, V] 6. Compare and/or order whole numbers. [C, R, V] 7. Represent and describe proper fractions concretely, pictorially and symbolically. [CN, R, V] *(continued on p. 30)*

Strand: Number (Number Concepts)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6

General Outcome

Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.

Specific Outcomes

1. Read and write numerals greater than a million. [C, CN]
2. Estimate quantities up to a million. [E]
3. Distinguish among, and find, multiples, factors, composites and primes, using numbers 1 to 100. [R]
4. Recognize, model, identify, find and describe common multiples, common factors, least common multiple, greatest common factor and prime factorization, using numbers 1 to 100. [C, PS, R, V]
5. Explain the meaning of integers by extending counting numbers to less than zero. [R]
6. Identify practical applications of integers. [CN, PS]
7. Read and write numbers to thousandths. [C, CN, V]
8. Round numbers to the nearest unit, tenth and hundredth.
9. Demonstrate and explain the meaning of improper fractions and mixed numbers (positive) concretely, pictorially and symbolically. [C, R, V]

(continued on p. 31)

7

General Outcome

Demonstrate a number sense for decimals and integers, including whole numbers.

Specific Outcomes

1. Define and use power, base and exponent to represent repeated multiplication. [C, T, V]
2. Write a whole number as:
   - an expanded numeral, using powers of 10
   - scientific notation, and vice versa.

   [C, CN, V]
3. Use divisibility rules to determine if a number is divisible by 2, 3, 4, 5, 6, 9, 10. [CN, R]
4. Read and write numbers to any number of decimal places. [C, CN, V]
5. Demonstrate and describe equivalent mixed numbers and improper fractions concretely, pictorially and symbolically. [C, R, V]
6. Compare and/or order improper fractions, mixed numbers and decimals to thousandths. [R, T, V]
7. Recognize and illustrate that all fractions and mixed numbers can be represented in decimal form (include terminating and repeating decimals). [R, V]
8. Convert from terminating decimals to fractions. [R]
9. Convert from single-digit repeater ($0.\dot{3}$) decimal numbers to fractions, using patterns. [CN, R, V]

(continued on p. 31)

8

General Outcome

Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.

Specific Outcomes

1. Demonstrate and explain the meaning of a negative exponent, using patterns (limit to base 10). [C, CN, R, V]
2. Represent any number in scientific notation. [R]
3. Define, compare and order any rational numbers. [R, T, V]
4. Demonstrate concretely, pictorially and symbolically that the product of reciprocals is equal to 1. [R, V]
5. Express 3-term ratios in equivalent forms. [CN]
6. Represent and apply fractional per cents, and per cents greater than 100, in fraction or decimal form, and vice versa. [CN, R]
7. Represent square roots concretely, pictorially and symbolically. [R, V]
8. Distinguish between a square root and its decimal approximation as it appears on a calculator. [T]

9

General Outcome

Explain and illustrate the structure and the interrelationship of the sets of numbers within the rational number system.

Specific Outcomes

1. Give examples of numbers that satisfy the conditions of natural, whole, integral and rational numbers, and show that these numbers comprise the rational number system. [C, CN, PS, R]
2. Describe, orally and in writing, whether or not a number is rational. [C, R]
3. Give examples of situations where answers would involve the positive (principal) square root, or both positive and negative square roots of a number. [C, CN, PS, R]

General Outcome

Develop a number sense of powers with integral exponents and rational bases.

Specific Outcomes

4. Illustrate power, base, coefficient and exponent, using rational numbers or variables as bases or coefficients. [R, V]

(continued on p. 31)

Strand: Number (Number Concepts) (continued)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
		(continued from p. 28) 9. Use ordinal numbers to 31. [C] 10. Explore the representation of numerals (0 to 100), using a calculator or a computer to display numerals. [PS, R, T] 11. Demonstrate if a number from 1 to 100 is even or odd. [C, CN] 12. Illustrate and explain halves, thirds and fourths as part of a region or a set. [C, R, V]	*(continued from p. 28)* 8. Read and write numerals to 1000. [C, CN, V] 9. Read and write number words to 100. [C, CN, V] 10. Use ordinal numbers to 100. [C] 11. Represent and describe numbers to 1000 in a variety of ways. [C, PS, R, T, V] 12. Recognize and explain if a number is divisible by 2, 5 or 10. [C, CN, R] 13. Illustrate and explain fifths and tenths as part of a region or a set. [C, R, V]	*(continued from p. 28)* 9. Sort numbers into categories, using one or more attributes. [CN, R] 10. Illustrate and explain hundredths as part of a region or set. [C, R, V] 11. Connect proper fractions to decimals (tenths and hundredths), using manipulatives, diagrams and symbols. [CN, R, V]	*(continued from p. 28)* 8. Demonstrate and describe equivalent proper fractions concretely, pictorially and symbolically. [C, R, V] 9. Compare and/or order proper fractions and decimals to hundredths. [C, R, V]

Strand: Number (Number Concepts) (continued)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
(continued from p. 29) 10. Demonstrate and explain the meaning of ratio concretely, pictorially and symbolically. [C, CN, R, V] 11. Demonstrate and explain the meaning of percentage concretely, pictorially and symbolically. [C, CN, R, V]	*(continued from p. 29)* 10. Demonstrate, concretely and pictorially, that the sum of opposite integers is zero. [R, V] 11. Represent integers in a variety of concrete, pictorial and symbolic ways. [R, V] 12. Compare and order integers. [R, V]		*(continued from p. 29)* 5. Explain and apply the exponent laws for powers with integral exponents. $x^m \bullet x^n = x^{m+n}$ $x^m \div x^n = x^{m-n}$ $(x^m)^n = x^{mn}$ $(xy)^m = x^m y^m$ $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, \ y \neq 0$ $x^0 = 1, \ x \neq 0$ $x^{-n} = \frac{1}{x^n}, \ x \neq 0$ [PS, R] 6. Determine the value of powers with integral exponents, using the exponent laws. [PS, R]

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Demonstrate awareness of addition and subtraction.	**General Outcome** Apply informal methods of addition and subtraction on whole numbers where the maximum sum is 18.	**General Outcome** Apply a variety of addition and subtraction strategies on whole numbers to 100, and use these operations in solving problems.	**General Outcome** Apply an arithmetic operation (addition, subtraction, multiplication or division) on whole numbers, and illustrate its use in creating and solving problems.	**General Outcome** Apply arithmetic operations on whole numbers, and illustrate their use in creating and solving problems.	**General Outcome** Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.
Specific Outcome 5. Represent the processes of addition and subtraction through role playing and the use of manipulatives. [C, CN, PS, V]	**Specific Outcome** 8. Use manipulatives and diagrams to demonstrate and describe the processes of addition and subtraction of numbers to 18. **Note**: memorization not intended. [C, PS, R, V]	**Specific Outcomes** 13. Use manipulatives, diagrams and symbols to demonstrate and describe the processes of addition and subtraction of numbers to 100. [C, R, V] 14. Apply and explain multiple strategies to determine sums and differences on 2-digit numbers, with and without regrouping. [C, PS, R] *(continued on p. 34)*	**Specific Outcomes** 14. Use manipulatives, diagrams and symbols, in a problem-solving context, to demonstrate and describe the processes of addition and subtraction to 1000, with and without regrouping. [C, PS, R, V] 15. Use manipulatives, diagrams and symbols with maximum products and dividends to 50, to demonstrate and describe the processes of multiplication and division. [C, PS, V] 16. Recall addition/subtraction facts to 18 and multiplication facts to 49 (7×7 on a multiplication grid). [E] *(continued on p. 34)*	**Specific Outcomes** 12. Use manipulatives, diagrams and symbols, in a problem-solving context, to demonstrate and describe the process of addition and subtraction of numbers up to 10 000. [C, PS, R, V] 13. Demonstrate and describe the process of multiplication (3-digit by 1-digit), using manipulatives, diagrams and symbols. [C, PS, R, T, V] 14. Demonstrate and describe the process of division (2-digit by a 1-digit), using manipulatives, diagrams and symbols. [C, PS, R, V] 15. Recall multiplication and division facts to 81 (9×9 on a multiplication grid). [E] *(continued on p. 34)*	**Specific Outcomes** 10. Add and subtract decimals to hundredths, concretely, pictorially and symbolically. [PS, V] 11. Estimate, mentally calculate, compute or verify, the product (3-digit by 2-digit) and quotient (3-digit divided by 1-digit) of whole numbers. [E, PS, T] 12. Multiply and divide decimals to hundredths, concretely, pictorially and symbolically, using single-digit, whole number multipliers and divisors. [PS, V] 13. Solve problems involving multiple steps and multiple operations, and accept that other methods may be equally valid. [PS]

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6

General Outcome

Apply arithmetic operations on whole numbers and decimals in solving problems.

Specific Outcomes

12. Solve problems that involve arithmetic operations on decimals to thousandths, using appropriate technology (2-digit whole number multipliers and dividers). [PS, R, T]
13. Estimate the solution to calculations involving whole numbers and decimals (2-digit whole number multipliers and divisors). [E, PS, R]
14. Use a variety of methods to solve problems with multiple solutions. [PS, R, T, V]

7

General Outcome

Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems.

Specific Outcomes

13. Use patterns, manipulatives and diagrams to demonstrate the concepts of multiplication and division by a decimal. [CN, PS, R, V]
14. Use estimation strategies to justify or assess the reasonableness of calculations. [E, PS]
15. Add, subtract, multiply and divide decimals (for more than 2-digit divisors or multipliers, the use of technology is expected). [E, PS, T]
16. Add, subtract, multiply and divide integers concretely, pictoriaily and symbolically. [PS, V]
17. Illustrate and explain the order of operations, using paper and pencil or a calculator. [PS, T, V]

General Outcome

Illustrate the use of rates, ratios, percentages and decimals in solving problems.

Specific Outcomes

18. Estimate and calculate percentages. [E, PS]
19. Distinguish between rate and ratio, and use them to solve problems. [PS]

(continued on p. 35)

8

General Outcome

Apply arithmetic operations on rational numbers to solve problems.

Specific Outcomes

9. Add, subtract, multiply and divide fractions concretely, pictorially and symbolically. [E, PS, V]
10. Estimate, compute and verify the sum, difference, product and quotient of rational numbers, using only decimal representations of negative rationals. [E, PS, T]
11. Estimate, compute (using a calculator) and verify approximate square roots of whole numbers and of decimals. [E, PS, T]

General Outcome

Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.

Specific Outcomes

12. Use concepts of rate, ratio, proportion and per cent to solve problems in meaningful contexts. [E, PS, T]
13. Calculate combined percentages in a variety of meaningful contexts. [CN, E, PS, T]

(continued on p. 35)

9

General Outcome

Use a scientific calculator or a computer to solve problems involving rational numbers.

Specific Outcomes

7. Document and explain the calculator keying sequences used to perform calculations involving rational numbers. [C, PS, T]
8. Solve problems, using rational numbers in meaningful contexts. [CN, PS]

General Outcome

Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.

Specific Outcomes

9. Understand and use the exponent laws to simplify expressions with variable bases and evaluate expressions with numerical bases. [PS, R]
10. Use a calculator to perform calculations involving scientific notation and exponent laws. [PS, R, T]

Strand: Number (Number Operations) (continued)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
		(continued from p. 32) **General Outcome** Use an appropriate calculation strategy or technology to solve problems. **Specific Outcomes** 15. Apply a variety of estimation and mental mathematics strategies to addition and subtraction problems. [E, PS, T] 16. Recall addition and subtraction facts to 10. 17. Demonstrate the processes of multiplication and division, using manipulatives and diagrams. [C, PS, V]	*(continued from p. 32)* **General Outcome** Use and justify an appropriate calculation strategy or technology to solve problems. **Specific Outcomes** 17. Verify solutions to addition and subtraction problems, using estimation and calculators. [E, PS, T] 18. Verify solutions to addition and subtraction problems, using the inverse operation. [PS, R] 19. Justify the choice of method for addition and subtraction, using: • estimation strategies • mental mathematics strategies • manipulatives • algorithms • calculators. [C, PS, R, T] 20. Calculate products and quotients, using estimation strategies and mental mathematics strategies. [E, R]	*(continued from p. 32)* **General Outcome** Use and justify an appropriate calculation strategy or technology to solve problems. **Specific Outcomes** 16. Verify solutions to multiplication and division problems, using estimation and calculators. [E, PS, R, T] 17. Verify solutions to multiplication and division problems, using the inverse operation. [PS, R] 18. Justify the choice of method for multiplication and division, using: • estimation strategies • mental mathematics strategies • manipulatives • algorithms • calculators. [C, PS, R, T, V] *(continued on p. 36)*	

Strand: Number (Number Operations) (continued)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
	(continued from p. 33) 20. Explain, demonstrate and use proportion in solving problems. [C, PS, V] 21. Convert, mentally, among fractions, decimals and per cents to facilitate the solution of problems. [E, PS]	*(continued from p. 33)* 14. Derive and apply unit rates. [PS, R] 15. Express rates and ratios in equivalent forms. [PS, R]	

Strand: Number (Number Operations) (continued)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
				(continued from p. 34) **General Outcome** Demonstrate an understanding of addition and subtraction of decimals. **Specific Outcome** 19. Demonstrate an understanding of addition and subtraction of decimals (tenths and hundredths), using concrete and pictorial representations. [C, PS, V]	

Strand: Number (Number Operations) (continued)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Identify and create patterns arising from daily experiences. **Specific Outcomes** 1. Sort objects, using a single attribute. [CN, R, V] 2. Recognize and reproduce a pattern, using actions and manipulatives. [C, CN, PS, V] 3. Extend and create a pattern, using actions and manipulatives. [C, CN, PS, R, V] 4. Describe, orally, a pattern. [C, CN]	**General Outcome** Identify, create and compare patterns arising from daily experiences in the classroom. **Specific Outcomes** 1. Sort objects, using a single given attribute determined by the student. [CN, PS, V] 2. Identify, name and reproduce patterns, using actions, manipulatives, diagrams and spoken terms. [C, PS, R, V] 3. Extend and create patterns, using actions, manipulatives, diagrams and spoken terms. [C, CN, PS, R, V] 4. Compare patterns, using actions, manipulatives, diagrams and spoken terms. [C, CN, V] 5. Begin to recognize patterns in the environment. [CN, PS, V]	**General Outcome** Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground. **Specific Outcomes** 1. Sort objects and shapes, using one or two attributes. [CN, PS, V] 2. Identify attributes and rules in presorted sets. [C, R] 3. Identify and describe patterns, including numerical and non-numerical patterns. [C, CN, PS] 4. Create, extend and describe patterns including numerical and non-numerical patterns. [C, PS, T, V] 5. Translate patterns from one mode to another: manipulatives, diagrams, charts, calculators, words, symbols. [C, CN, T, V]	**General Outcome** Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions. **Specific Outcomes** 1. Sort, concretely and pictorially, using two or more attributes. [CN, PS, V] 2. Use objects and concrete models to explain the rule for a pattern, such as those found on addition and multiplication charts. [C, R, V] 3. Make predictions based on addition and multiplication patterns. [PS, R]	**General Outcome** Investigate, establish and communicate rules for, and predictions from, numerical and non-numerical patterns, including those found in the community. **Specific Outcomes** 1. Identify and explain mathematical relationships and patterns, using: • grids/tables/objects • Venn/Carroll/tree diagrams • graphs • objects or models • technology. [C, CN, PS, R, T] 2. Make and justify predictions, using numerical and non-numerical patterns. [C, PS, R]	**General Outcome** Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators. **Specific Outcomes** 1. Develop charts to record and reveal patterns. [CN, PS] 2. Describe how a pattern grows, using everyday language in spoken and written form. [C, CN] 3. Construct and expand patterns in two and three dimensions, concretely and pictorially. [PS, V] 4. Generate and extend number patterns from a problem-solving context. [PS, R] 5. Predict and justify pattern extensions. [C, R]

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
General Outcome Use relationships to summarize, generalize and extend patterns, including those found in music and art. **Specific Outcomes** 1. Represent, visually, a pattern to clarify relationships and to verify predictions. [C, R, V] 2. Summarize a relationship, using everyday language in spoken or written form. [C, R] 3. Create expressions and rules to describe, complete and extend patterns and relationships. [C, CN, PS, R] 4. Find approximate number values from a given graph. [PS, R]	**General Outcome** Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions. **Specific Outcomes** 1. Predict and justify possible *n*th values of a number pattern. [C, CN, R] 2. Interpolate and extrapolate number values from a given graph. [E, PS, V] 3. Graph relations, analyze the result and draw a conclusion from a pattern. [R, V] 4. Use patterns and relations to represent simple oral and written expressions as mathematical symbols, and vice versa. [CN, PS, R]	**General Outcome** Use patterns, variables and expressions, together with their graphs, to solve problems. **Specific Outcomes** 1. Generalize a pattern arising from a problem-solving context, using mathematical expressions and equations, and verify by substitution. [C, CN, PS, R] 2. Substitute numbers for variables in expressions, and graph and analyze the relation. [C, PS, R, V] 3. Translate between an oral or written expression and an equivalent algebraic expression. [C, CN]	**General Outcome** Generalize, design and justify mathematical procedures, using appropriate patterns, models and technology. **Specific Outcomes** 1. Use logic and divergent thinking to present mathematical arguments in solving problems. [C, PS, R] 2. Model situations that can be represented by first-degree expressions. [CN, PS] 3. Write equivalent forms of algebraic expressions, or equations, with rational coefficients. [C, CN, R]

Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5

92

93

Strand: Patterns and Relations (Variables and Equations) (continued)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
General Outcome Use informal and concrete representations of equality and operations on equality to solve problems. **Specific Outcomes** 5. Demonstrate and explain the meaning and preservation of equality by balancing objects, or by using models and diagrams. [C, CN, PS, R, V] 6. Use pre-algebra strategies to solve equations with one unknown and with whole number coefficients and solutions. [PS, R]	**General Outcome** Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts. **Specific Outcomes** 5. Write mathematical expressions that arise from problem-solving contexts. [C, CN, PS] 6. Evaluate expressions with and without concrete models. [R, V] 7. Illustrate the solution process for a one-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V] 8. Solve and verify one-step linear equations, using a variety of techniques. [PS, R] 9. Explain how to solve simple problems, using informal algebraic methods. [C, PS, R]	**General Outcome** Solve and verify one-step and two-step linear equations with rational number solutions. **Specific Outcomes** 4. Illustrate the solution process for a two-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V] 5. Solve and verify one- and two-step, first-degree equations of the form: • $x+a=b$ • $ax=b$ • $\frac{x}{a}=b$ • $ax+b=c$ • $\frac{x}{a}+b=c$ where a, b and c are integers. [PS, V] 6. Create and solve problems, using first-degree equations. [PS]	**General Outcome** Solve and verify linear equations and inequalities in one variable. **Specific Outcomes** 4. Illustrate the solution process for a first-degree, single-variable equation, using concrete materials or diagrams. [PS, R, V] 5. Solve and verify first-degree, single-variable equations of forms, such as: • $ax=b+cx$ • $a(x+b)=c$ • $ax+b=cx+d$ • $a(bx+c)=d(ex+f)$ • $a/x=b$ where a, b, c, d, e and f are all rational numbers (with a focus on integers), and use equations of this type to model and solve problem situations. [C, PS, V] 6. Solve, algebraically, first-degree inequalities in one variable, display the solutions on a number line and test the solutions. [PS, R, V] *(continued on p. 43)*

Strand: Patterns and Relations (Variables and Equations) (continued)

Students will:

- **represent algebraic expressions in multiple ways.**

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5

Strand: Patterns and Relations (Variables and Equations) (continued)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
			(continued from p. 41) **General Outcome** Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcomes** 7. Identify constant terms, coefficients and variables in polynomial expressions. [C] 8. Evaluate polynomial expressions, given the value(s) of the variable(s). [E] 9. Represent and justify the addition and subtraction of polynomial expressions, using concrete materials and diagrams. [C, R, V] 10. Perform the operations of addition and subtraction on polynomial expressions. [R] 11. Represent multiplication, division and factoring of monomials, binomials, and trinomials of the form x^2+bx+c, using concrete materials and diagrams. [R, V] 12. Find the product of two monomials, a monomial and a polynomial, and two binomials. [R] 13. Determine equivalent forms of algebraic expressions by identifying common factors and factoring trinomials of the form x^2+bx+c. [PS, R] 14. Find the quotient when a polynomial is divided by a monomial. [R]

Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Demonstrate awareness of measurement. **Specific Outcomes** 1. Classify and describe linear attributes of objects; e.g., long, short. [C] 2. Arrange objects in order of size, by length or by height. [E, PS] 3. Cover a surface with a variety of objects. [PS, V] 4. Use the words full, empty, less and more, to talk about volume and capacity. [C] 5. Use the words heavier or lighter, to talk about the mass (weight) of two objects. [C] 6. Use the terms long time or short time, to talk about the duration of events. [C] 7. Use words like hot, hotter; cold, colder; warm, warmer; cool, cooler to talk about temperature. [C] 8. Exchange play money for objects in a play store. [E, PS]	**General Outcome** Estimate, measure and compare, using whole numbers and nonstandard units of measure. **Specific Outcomes** 1. Select an appropriate nonstandard unit to measure length. [R, V] 2. Estimate, measure, record, compare and order objects by length, height and distance around, using nonstandard units. [E, PS] 3. Estimate the number of uniform objects or shapes that will cover the surface of a design, and verify by covering and counting. [E, V] 4. Estimate the number of irregular shapes that will cover a given area, and verify by covering and counting. [E, V] 5. Estimate, measure, record and compare the volume/capacity of containers, using nonstandard units. [E, PS] *(continued on p. 46)*	**General Outcome** Estimate, measure and compare, using standard units for length and primarily nonstandard units for other measures. **Specific Outcomes** 1. Construct items of specific lengths (cm, dm, m). [E, V] 2. Select the most appropriate standard unit (cm, dm, m) to measure a length. [E, V] 3. Estimate, measure, record, compare and order objects by length, height and distance around, using standard units (cm, dm, m). [E, PS] 4. Estimate, measure, record and compare the area of shapes, using nonstandard units. [E, PS] 5. Construct a shape given a specific area in nonstandard units. [PS, V] *(continued on p. 46)*	**General Outcome** Estimate, measure and compare, using whole numbers and primarily standard units of measure. **Specific Outcomes** 1. Select the most appropriate standard unit, including km, to measure length. [E, R, V] 2. Describe the relationships among cm, dm and m. [C] 3. Estimate, measure, record, compare and order objects by length, height and perimeter, using standard units. [E, PS] 4. Select an appropriate nonstandard unit to measure area. [E, V] 5. Estimate, measure, record, compare and order shapes by area, using nonstandard units. [E, PS] *(continued on p. 46)*	**General Outcome** Estimate, measure and compare, using decimal numbers and standard units of measure. **Specific Outcomes** 1. Construct items of specific lengths, including mm. [E, V] 2. Select the most appropriate standard unit to measure length. [E, R, V] 3. Describe the relationships among mm, cm, dm, m and km. [C] 4. Estimate, measure, record, compare and order objects by length, height, perimeter and circumference, using standard units. [E, PS] *(continued on p. 46)*	**General Outcome** Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts. **Specific Outcomes** 1. Recognize and explain the meaning of length, width, height, depth, thickness, perimeter and circumference. [C] 2. Evaluate the appropriateness of units and measuring tools in practical contexts. [CN] 3. Estimate and measure the perimeter of irregular shapes. [E, R] 4. Estimate and measure the area of irregular shapes by dividing them into parts. [E, R] *(continued on p. 46)*

Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6

General Outcome

Solve problems involving perimeter, area, surface area, volume and angle measurement.

Specific Outcomes

1. Use conversions among commonly used SI units of length, mass (weight) and capacity (volume) to solve problems. [E, PS]
2. Develop, verify and use rules or expressions for the perimeter of polygons. [CN, PS, R]
3. Develop, verify and apply rules or expressions for the area of rectangles (mm^2, cm^2, m^2, ha and km^2). [CN, PS, R]
4. Estimate and determine the surface area of a right rectangular prism, without using a formula. [E, PS]
5. Discover, generalize and use rules for the volume of right rectangular prisms. [PS, R]
6. Design and construct rectangles, given one or both of perimeter and area, using whole numbers. [PS, R]
7. Demonstrate concretely, pictorially and symbolically that many rectangles are possible for a given perimeter or a given area. [CN, R]

(continued on p. 47)

7

General Outcome

Solve problems involving the properties of circles and their connections with angles and time zones.

Specific Outcomes

1. Measure the diameters, radii and circumferences of circles, and establish the relationships among them. [CN, R]
2. Solve problems involving the radii, diameters and circumferences of circles. [PS, T]
3. Explain how time zones are determined. [C, PS]
4. Research and report how measurement instruments are used in the community. [C, CN]

8

General Outcome

Apply indirect measurement procedures to solve problems.

Specific Outcomes

1. Use concrete materials and diagrams to develop the Pythagorean relationship. [CN, R]
2. Use the Pythagorean relationship to calculate the measure of the third side, of a right triangle, given the other two sides in 2-D applications. [PS]

General Outcome

Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.

Specific Outcomes

3. Describe patterns, and generalize the relationships by determining the areas and perimeters of quadrilaterals and the areas and circumferences of circles. [C, CN, PS, T]
4. Estimate, measure and calculate the surface area and volume of any right prism or cylinder. [E, PS, T]

(continued on p. 47)

9

General Outcome

Use trigonometric ratios to solve problems involving a right triangle.

Specific Outcomes

1. Explain the meaning of sine, cosine and tangent ratios in right triangles. [C]
2. Demonstrate the use of trigonometric ratios (sine, cosine and tangent) in solving right triangles. [PS]
3. Calculate an unknown side or an unknown angle in a right triangle, using appropriate technology. [PS, T]
4. Model and then solve given problem situations involving only one right triangle. [PS, T, V]

General Outcome

Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.

Specific Outcomes

5. Relate expressions for volumes of pyramids to volumes of prisms, and volumes of cones to volumes of cylinders. [CN, R]

(continued on p. 47)

Strand: Shape and Space (Measurement) (continued)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
	(continued from p. 44) 6. Estimate, measure, record and compare the mass (weight) of objects, using nonstandard units. [E, PS] 7. Recognize that different objects may have the same mass (weight). [CN] 8. Estimate and measure the passage of time related to nonstandard units. [E] 9. Sequence events within one day and over several days. [R] 10. Compare the duration of activities. [E] 11. Describe the time of day; e.g., morning, afternoon. [C] 12. Name, in order, the days of the week and the seasons of the year. [C] 13. Describe and compare temperatures, using the senses. [C, E] 14. Recognize and name coins; pennies, nickels, dimes, quarters, one dollar. [C] 15. State the value, in cents, of pennies, nickels and dimes. [C] 16. Create equivalent sets of coins up to 10¢ in value. [PS, R]	*(continued from p. 44)* 6. Estimate, measure, record, compare and order the capacity of containers, using nonstandard units. [E, PS] 7. Estimate, measure, record, compare and order the mass (weight) of objects, using nonstandard units. [E, PS] 8. Recognize that the size and shape of an object does not necessarily determine its mass (weight). [CN] 9. Estimate and measure the passage of time related to minutes and hours. [E] 10. Select the most appropriate standard unit to measure a given period of time. [E, R] 11. Name, in order, the months of the year. [C] 12. Relate the number of days to a week, months to a year, minutes to an hour, hours to a day. [CN] 13. Read the date on a calendar. [C] 14. Use a thermometer to determine rising and falling temperatures. [CN] *(continued on p. 48)*	*(continued from p. 44)* 6. Construct a variety of shapes given a specific area in nonstandard units. [PS, V] 7. Select an appropriate object or nonstandard unit to measure capacity or volume of a container. [E, V] 8. Estimate, measure, record, compare and order containers by volume/capacity, using: • nonstandard units • litres. [E, PS] 9. Estimate, measure, record, compare and order the mass (weight) of objects, using standard units (g, kg). [E, PS] 10. Construct objects to equal a given mass (weight). [PS] 11. Estimate and measure the passage of time, using standard units; seconds, minutes, hours, days, weeks, months, years. [E] *(continued on p. 48)*	*(continued from p. 44)* 5. Estimate, measure, record, compare and order shapes by area, using standard units (cm^2, m^2). [E, PS] 6. Construct a number of shapes given a specific area (cm^2). [PS] 7. Select the most appropriate standard unit to measure area. [E, V] 8. Relate the size of a unit to the number of units used to measure: • length • volume/capacity • area. [CN, R] 9. Estimate, measure, record, compare and order the capacity of containers, using standard units (mL, L). [E, PS] *(continued on p. 48)*	*(continued from p. 44)* 5. Estimate and measure the effect of changing one or more dimensions of a rectangle on its: • perimeter • area. [E, R] 6. Relate perimeter and area of rectangles, using manipulatives and diagrams. [CN, R] 7. Estimate, measure, record and order containers by volume, using cm^3. [E, PS] 8. Use concrete materials to relate cm^3 to mL. [CN,V] 9. Construct objects of a specific volume, expressed in cm^3. [PS] 10. Solve problems involving mass (weight), using g, kg and t. [PS] 11. Read an analog clock to the nearest minute, and write the time. [C] 12. Read and write time on a 24-hour clock. [C] 13. Read and write SI notation for recording date and time. [C]

Strand: Shape and Space (Measurement) (continued)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
(continued from p. 45) 8. Determine the volume of an object by measuring the displacement of a liquid by that object (cm^3 or mL). [PS, R] 9. Recognize angles as being more than 90 degrees, equal to 90 degrees, less than 90 degrees, equal to 180 degrees, greater than 180 degrees. [V] 10. Estimate and measure angles, using a circular protractor. [E] 11. Sketch and draw an angle when the degree measure is specified. [E, V] 12. Classify given angles as acute, right, obtuse, straight and reflex. [E] 13. Identify and compare examples of angles in the environment. [CN, V]		*(continued from p. 45)* 5. Estimate and calculate the area of composite figures. [E, PS, R] 6. Estimate, measure and calculate the surface area of composite 3-D objects. [E, PS, R] 7. Estimate, measure and calculate the volume of composite 3-D objects. [E, PS, R]	*(continued from p. 45)* 6. Calculate and apply the rate of volume to surface area to solve design problems in three dimensions. [PS, T, V] 7. Calculate and apply the rate of area to perimeter to solve design problems in two dimensions. [PS, T, V]

Strand: Shape and Space (Measurement) (continued)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
		(continued from p. 46) 15. Create equivalent sets of coins, using pennies, nickels and dimes, up to $1 in value. [PS, R] 16. Estimate, count and record, using the cents symbol only, the value of collections of coins up to $1. [E] 17. Recognize and state the value, in cents, of a quarter, a dollar and bills to $10. [C]	*(continued from p. 46)* 12. Read and write the days of the week and months of the year. [C] 13. Relate days to years. [CN] 14. Read digital clocks and write time to the nearest minute, using 12-hour notation. [C] 15. Estimate, read and record temperature to the nearest degree C. [E] 16. Relate temperature to everyday situations. [CN] 17. Create and recognize that a given value of money can be represented in many different ways. [PS, R] 18. Estimate, count and record collections of coins and bills up to $10. [E] 19. Make purchases and change up to $10. [PS] 20. Read and write both money notations (89¢ and $0.89). [C] 21. Recognize the value of bills up to $100. [C]	*(continued from p. 46)* 10. Describe the relationship between g and kg. [C] 11. Solve problems involving mass (weight), using g and kg. [PS] 12. Relate the size of a unit to the number of units used to measure mass (weight). [R] 13. Relate years to decades; decades to centuries; centuries to millenniums. [CN] 14. Read an analog clock to the nearest 5 minutes, and write time, using am and pm. [C] 15. Estimate, count and record collections of coins and bills up to $50. [E] 16. Make purchases and change up to $50. [PS]	

Strand: Shape and Space (Measurement) (continued)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Sort, classify and build real-world objects. **Specific Outcomes** 9. Identify, sort and classify 3-D objects in the environment. [CN, R] 10. Describe, and discuss orally, objects, using such words as big, little, round, like a box, like a can. [C] 11. Build 3-D objects. [PS, V]	**General Outcome** Explore and classify 3-D objects and 2-D shapes, according to their properties. **Specific Outcomes** 17. Explore, classify and describe 3-D objects according to two attributes. [C, PS, R, V] 18. Observe and build a given 3-D object. [E, PS, V] 19. Identify, name and describe specific 2-D shapes as: • circles • triangles • rectangles. [C, R] 20. Compare, sort and classify 2-D shapes. [CN, E, R]	**General Outcome** Name, describe and construct a variety of 3-D objects and 2-D shapes. **Specific Outcomes** 18. Explore faces, vertices and edges of 3-D objects. [R] 19. Identify, name and describe specific 3-D objects as: • cubes • spheres • cones • cylinders • pyramids. [C] 20. Build a skeleton of a 3-D object, and describe how the skeleton relates to the object. [E, PS, V] 21. Build and rearrange a pattern, using a set of 2-D shapes. [E, PS, V] 22. Match and make identical (congruent) 2-D shapes. [PS, T, V]	**General Outcome** Describe, classify, construct and relate 3-D objects and 2-D shapes. **Specific Outcomes** 22. Identify and count faces, vertices and edges of 3-D objects. [E] 23. Identify and name faces of a 3-D object with appropriate 2-D names. [C, V] 24. Describe and name pyramids and prisms by the shape of the base. [C] 25. Demonstrate that a rectangular solid has more than one net. [PS, V] 26. Compare and contrast two 3-D objects. [C, CN] 27. Recognize congruent (identical) 3-D objects and 2-D shapes. [CN] 28. Explore, concretely, the concepts of perpendicular, parallel and intersecting lines on 3-D objects. [R, V]	**General Outcome** Describe, classify, construct and relate 3-D objects and 2-D shapes, using mathematical vocabulary. **Specific Outcomes** 17. Design and construct nets for pyramids and prisms. [E, PS, V] 18. Relate nets to 3-D objects. [CN, V] 19. Compare and contrast: • pyramids • prisms • pyramids and prisms. [C, R] 20. Recognize, from everyday experience, and identify: • point • line • parallel lines • intersecting lines • perpendicular lines • vertical lines • horizontal lines. [C, V] 21. Classify angles in a variety of orientations according to whether they are right angle, less than right angle, or greater than right angle. [E, V] 22. Identify and sort specific quadrilaterals, including squares, rectangles, parallelograms and trapezoids. [R, V]	**General Outcome** Use visualization of 3-D objects and 2-D shapes to solve problems related to spatial relations. **Specific Outcomes** 14. Construct, analyze and classify triangles according to the side measures. [E, R, V] 15. Build, represent and describe geometric objects and shapes. [C, PS] 16. Identify and name polygons according to the number of sides, angles and vertices (3, 4, 5, 6 or 8). [C, R, V] 17. Cover a given 2-D shape with tangram pieces. [PS, V] 18. Complete the drawing of a 3-D object, on grid paper, given the front face. [E, V] 19. Determine, experimentally, the minimum information needed to draw a given 2-D shape. [R, V]

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
General Outcome Use visualization and symmetry to solve problems involving classification and sketching. **Specific Outcomes** 14. Classify triangles according to the measures of their angles. [C, E] 15. Sort quadrilaterals and regular polygons according to the number of lines of symmetry. [V] 16. Reproduce a given geometric drawing on grid paper. [V] 17. Sketch 3-D solids and skeletons with and without grids. [PS, T, V] 18. Recognize and appreciate optical illusions. [V]	**General Outcome** Link angle measures to the properties of parallel lines. **Specific Outcomes** 5. Measure and classify pairs of angles as complementary or supplementary angles. [E] 6. Investigate, identify and name pairs of angles pertaining to parallel lines and transversals, including: • corresponding • vertically opposite • interior on the same side of the transversal • exterior on the same side of the transversal • alternate angles. [C, V] 7. Describe the relationships between the pairs of angles pertaining to parallel lines and transversals. [C, R, T] 8. Explain, in more than one way, why the sum of the measures of the angles of a triangle is 180°. [C, R, T] 9. Use mathematical reasoning to determine the measures of angles in a diagram. [R, V] 10. Construct angle bisectors and perpendicular bisectors. [R, T, V]	**General Outcome** Link angle measures and the properties of parallel lines to the classification and properties of quadrilaterals. **Specific Outcomes** 8. Identify, investigate and classify quadrilaterals, regular polygons and circles, according to their properties. [PS, R, T] 9. Build 3-D objects from a variety of representations (nets, skeletons). [PS, V]	**General Outcome** Specify conditions under which triangles may be similar or congruent, and use these conditions to solve problems. **Specific Outcomes** 8. Recognize when, and explain why, two triangles are similar, and use the properties of similar triangles to solve problems. [C, PS, R, T] 9. Recognize when, and explain why, two triangles are congruent, and use the properties of congruent triangles to solve problems. [C, CN, PS, R, T] 10. Relate congruence to similarity in the context of triangles. [CN, R] **General Outcomes** Use spatial problem solving in building, describing and analyzing geometric shapes. **Specific Outcomes** 11. Draw the plan and elevations of a 3-D object from sketches and models. [C, R, T, V] 12. Sketch or build a 3-D object, given its plan and elevation views. [C, PS, T, V] 13. Recognize and draw the locus of points in solving practical problems. [PS, T, V]

Strand: Shape and Space (Transformations)

Students will:

- perform, analyze and create transformations.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Describe, orally, the position of 3-D objects. **Specific Outcome** 12. Describe the relative position of 3-D objects, using such words as over, under, beside, between, inside, outside. [C]	**General Outcome** Describe, orally, the relative position of 3-D objects and 2-D shapes. **Specific Outcomes** 21. Describe the relative position of 3-D objects and 2-D shapes, using such words as near, far, left, right. [C] 22. Match size and shape of figures by superimposing one on top of the other. [E] 23. Explore and describe reflections in a mirror. [CN, V]	**General Outcome** Apply positional language, orally and in writing, to communicate motion. **Specific Outcomes** 23. Communicate and apply positional language in oral, written or numerical form. [C] 24. Create symmetrical 2-D shapes by folding and reflecting. [PS, V]	**General Outcome** Use numbers and direction words to describe the relative positions of objects in one dimension, using everyday contexts. **Specific Outcomes** 29. Communicate and apply terms of direction, such as north or south and east or west, and relate to maps. [C, CN, T] 30. Graph whole number points on a horizontal number line or a vertical number line. [CN, V] 31. Trace a path, using oral or written instructions. [C, PS]	**General Outcome** Use numbers and direction words to describe the relative positions of objects in two dimensions, using everyday contexts. **Specific Outcomes** 23. Communicate and apply terms of direction, such as north, south, east, west, and relate to maps and grids. [T] 24. Place an object on a grid, using columns and rows. [C, CN] 25. Trace a path, using oral or written instructions, and write instructions for a given path. [C, PS, T] 26. Create and verify symmetrical 2-D shapes by drawing lines of symmetry. [PS, V]	**General Outcome** Describe motion in terms of a slide, a turn or a flip. **Specific Outcomes** 20. Recognize motion as a slide (translation), turn (rotation) or a flip (reflection). [T, V] 21. Recognize tessellations created with regular and irregular shapes in the environment. [CN, V] 22. Cover a surface, using one or more tessellating shapes. [PS, T, V] 23. Create tessellations, using regular polygons. [PS, T] 24. Identify planes of symmetry by cutting solids. [PS, V] **General Outcome** Use coordinates to describe the positions of objects in two dimensions. **Specific Outcomes** 25. Plot whole number ordered pairs in the first quadrant with intervals of 1, 2, 5, 10. [C] 26. Identify a point in the first quadrant, using ordered pairs. [C]

Strand: Shape and Space (Transformations)

Students will:

- perform, analyze and create transformations.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
General Outcome Create patterns and designs that incorporate symmetry, tessellations, translations and reflections. **Specific Outcomes** 19. Create, analyze and describe designs, using translations (slides) and reflections (flips). [C, T, V] 20. Draw designs, using ordered pairs, in the first quadrant of the coordinate grid. [PS, V]	**General Outcome** Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection. **Specific Outcomes** 11. Create, analyze and describe designs, using translations (slides), rotations (turns) and reflections (flips). [C, T, V] 12. Use informal concepts of congruence to describe images after translations, rotations and reflections. [C, T] 13. Draw designs, using ordered pairs, in all four quadrants of the coordinate grid, together with translation and reflection images. [PS, V] 14. Relate reflections to lines and planes of symmetry. [CN, V]	**General Outcome** Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks. **Specific Outcomes** 10. Represent, analyze and describe enlargements and reductions. [CN, R] 11. Draw and interpret scale diagrams. [PS, T] 12. Represent, analyze and describe regions and colouring problems. [C, PS, V] 13. Describe, analyze and solve network problems; e.g., bus routes, a telephone exchange. [C, E, PS]	**General Outcome** Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes. **Specific Outcomes** 14. Draw the image of a 2-D shape as a result of: • a single transformation • a dilatation • combinations of translations and/or reflections. [PS, T, V] 15. Identify the single transformation that connects a shape with its image. [R] 16. Demonstrate that a triangle and its dilatation image are similar. [R] 17. Demonstrate the congruence of a triangle with its: • translation image • rotation image • reflection image. [R]

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
General Outcome Collect and organize, with assistance, data based on first-hand information. **Specific Outcomes** 1. Collect, with assistance, first-hand information. [C, PS] 2. Construct, with assistance, a concrete/object graph, using one-to-one correspondence. [PS, V] 3. Compare data in two categories, using such words as more, less, the same. [C, CN]	**General Outcome** Collect, organize and describe, with guidance, data based on first-hand information. **Specific Outcomes** 1. Collect, with guidance, first-hand information by counting objects, conducting surveys, measuring and performing simple experiments. [C, PS] 2. Construct, with guidance, a concrete/object graph and a pictograph, using one-to-one correspondence. [CN, PS, V] 3. Compare data, using appropriate language, including quantitative terms, such as how many more. [C, E] 4. Pose oral questions in relation to the data gathered. [C, PS]	**General Outcome** Collect, display and describe data, independently, based on first-hand information. **Specific Outcomes** 1. Formulate the questions and categories for data collection, and actively collect first-hand information. [C, PS, R] 2. Choose an appropriate recording method, such as tally marks, to collect data. [R] 3. Organize data, using such graphic organizers as diagrams, charts and lists. [CN, PS] 4. Construct and label concrete/object graphs, pictographs and bar graphs. [PS, V] 5. Discuss data, and draw and communicate appropriate conclusions. [C, R] 6. Generate new questions from displayed data. [C, R]	**General Outcome** Collect first- and second-hand data, display the results in more than one way, and interpret the data to make predictions. **Specific Outcomes** 1. Collect data, using measuring devices and printed/technology resources. [PS, T] 2. Display data, using rank ordering. [C, V] 3. Display the same data in more than one way. [PS] 4. Make predictions and inferences when solving similar problems. [CN, E, PS] 5. Obtain new information by performing arithmetic operations on the data. [E, PS, T]	**General Outcome** Collect first- and second-hand data, assess and validate the collection process, and graph the data. **Specific Outcomes** 1. Select a sample or population, and organize the collection of data. [PS] 2. Manipulate data to create an interval graph/table for display purposes. [PS, V] 3. Construct a bar graph and a pictograph, using many-to-one correspondence, and justify the choice of intervals and correspondence used. [C, T, V] 4. Discuss the process by which the data was collected. [C, R]	**General Outcome** Develop and implement a plan for the collection, display and interpretation of data to answer a question. **Specific Outcomes** 1. Identify a question to generate appropriate data, and predict results. [C, R] 2. Distinguish between a total population and a sample of that population. [R] 3. Use a variety of methods to collect and record data. [PS, T] 4. Evaluate the graphic presentation of the data to ensure clear representation of the results. [C, R] 5. Create classifications and ranges for grouping data. [PS, R] 6. Display data by hand or by computer in a variety of ways, including: • frequency diagrams • line plots • broken-line graphs. [C, T, V] *(continued on p. 56)*

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6

General Outcome

Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.

Specific Outcomes

1. Formulate questions for possible investigation, given a context. [C, R]
2. Identify appropriate data sources: first-hand, second-hand and combination. [R]
3. Select and use appropriate methods of collecting data:
   - designing and using structured questionnaires
   - experiments
   - observations
   - electronic networks.

   [C, PS, T]
4. Select and defend the choice of an appropriate sample or population to be used to answer a question. [C, R]
5. Discuss how collected data are affected by the nature of the sample, the method of collection, the sample size and biases. [C, CN]
6. Display data by hand or by computer in a variety of ways, including:
   - histograms
   - double bar graphs
   - stem and leaf plots.

   [C, T, V]

(continued on p. 57)

7

General Outcome

Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.

Specific Outcomes

1. Formulate questions for investigation, from a real-world context. [C, CN, R]
2. Select, defend and use appropriate methods of collecting data:
   - designing and using questionnaires
   - interviews
   - experiments
   - research.

   [C, PS, T]
3. Describe issues to be considered when collecting data; e.g., appropriate language, ethics, cost, privacy, cultural sensitivity. [C, CN, R]
4. Display data by hand or by computer in a variety of ways, including circle graphs. [C, T, V]
5. Read and interpret graphs. [C, E, PS, R]
6. Determine measures of central tendency for a set of data:
   - mode
   - median
   - mean.

   [PS]

(continued on p. 57)

8

General Outcome

Develop and implement a plan for the collection, display and analysis of data, using technology, as required.

Specific Outcomes

1. Formulate questions for investigation, using existing data. [C, CN, R]
2. Select, defend and use appropriate methods of collecting data:
   - designing and using surveys
   - research, using electronic media.

   [C, PS, T]
3. Display data by hand or by computer in a variety of ways, including box and whisker plots. [C, T, V]

General Outcome

Evaluate and use measures of central tendency and variability.

Specific Outcomes

4. Determine and use the most appropriate measure of central tendency in a given context. [CN, PS, T]
5. Describe the variability of data sets, using such techniques as range, and box and whisker plots. [C, PS, T]

(continued on p. 57)

9

General Outcome

Collect and analyze experimental results expressed in two variables, using technology, as required.

Specific Outcomes

1. Design, conduct and report on an experiment to investigate a relationship between two variables. [C, CN, PS]
2. Create scatter plots for discrete and continuous variables. [C, V]
3. Interpret a scatter plot to determine if there is an apparent relationship. [E, R]
4. Determine the lines of best fit from a scatter plot for an apparent linear relationship by:
   - inspection
   - using technology (equations are not expected).

   [E, PS, T]
5. Draw and justify conclusions from the line of best fit. [C, R]
6. Assess the strengths, weaknesses and biases of samples and data collection methods. [C, R, T]
7. Critique ways in which statistical information and conclusions are presented by the media and other sources. [C, CN]

Strand: Statistics and Probability (Data Analysis) (continued)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
					(continued from p. 54) 7. Discuss the reasonableness of data and results. [C, R] 8. Make inferences to generate a conclusion about the data. [E, PS]

...nd: Statistics and Probability (Data Analysis) (continued)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
(continued from p. 55) 7. Read and interpret graphs that are provided. [C, E, PS, R] 8. Describe the general distribution of data, using: • smallest and largest value • frequency • value in the middle • patterns. [C, CN] 9. Analyze sets of data to make comparisons. [E, PS, R]	*(continued from p. 55)* 7. Determine measures of the distribution of a set of data: • range • extremes, gaps and clusters • quartiles. [PS] 8. Interpolate from data to make predictions. [E, PS, R]	*(continued from p. 55)* 6. Construct sets of data given measures of central tendency and variability. [PS, R] 7. Determine the effect on the mean, median and/or mode when: • a constant is added or subtracted from each value • each value is multiplied or divided by the same constant • a significantly different value is included. [E, PS, R]	

Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

- use experimental or theoretical probability to represent and solve problems involving uncertainty.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

K	1	2	3	4	5
	General Outcome Describe concepts of chance and chance events, using ordinary vocabulary. **Specific Outcome** 5. Predict the chance of an event happening, using the terms never, sometimes, always. [C, R]	**General Outcome** Use simple experiments, designed by others, to illustrate chance. **Specific Outcomes** 7. Describe the likelihood of an outcome, using such terms as likely, unlikely, expect, probably. [C, R] 8. Make a prediction based on a simple probability experiment. [E, PS]	**General Outcome** Use simple probability experiments, designed by others, to explain outcomes. **Specific Outcomes** 6. Describe the likelihood of an outcome, using such terms as more likely, less likely, chance. [C, R] 7. Conduct a probability experiment, choose an appropriate recording method, and draw conclusions from the results. [C, E, PS]	**General Outcome** Design and use simple probability experiments to explain outcomes. **Specific Outcomes** 5. Identify an outcome as possible, impossible, certain, uncertain. [C, R] 6. Compare outcomes as equally likely, more likely, less likely. [C, R] 7. Design and conduct experiments to answer one's own questions. [C, E, PS]	**General Outcome** Predict outcomes, conduct experiments and communicate the probability of single events. **Specific Outcomes** 9. List all possible outcomes of an experiment involving a single event. [PS] 10. Describe events, using the vocabulary of probability: • best/worst • probable/improbable • always/more likely/ equally likely/less likely/never. [C, R] 11. Conduct probability experiments, and explain the results, using the vocabulary of probability. [C, E, PS] 12. Conduct probability experiments to demonstrate that results are not influenced by such factors as the age, experiences or skills of the participant. [R, T]

Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

- use experimental or theoretical probability to represent and solve problems involving uncertainty.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

6	7	8	9
General Outcome Use numbers to communicate the probability of single events from experiments and models. **Specific Outcomes** 10. Distinguish between experimental and theoretical probability for single events. [PS, R] 11. Make the connection between the number of faces, for various dice, and the probability of a single event. [CN, R] 12. Calculate theoretical probability, using numbers between 0 and 1. [E, PS] 13. Demonstrate that different outcomes may occur when repeating the same experiment. [PS, T] 14. Compare experimental results with theoretical results. [C, E, R]	**General Outcome** Create and solve problems, using probability. **Specific Outcomes** 9. Use a table to identify all possible outcomes of two independent events. [PS, R] 10. Create and solve problems, using the numerical definition of probability as favourable outcomes divided by possible outcomes. [PS, R] 11. Use the Monte Carlo simulation method to solve probability problems. [CN, E, PS, T]	**General Outcome** Compare theoretical and experimental probability of independent events. **Specific Outcomes** 8. Use computer or other simulations to solve probability and data collection problems. [E, PS, T] 9. Recognize that if n events are equally likely the probability of any one of them occurring is $\frac{1}{n}$. [R] 10. Determine the probability of two independent events where the combined sample space has 52 or fewer elements. [PS, R, V] 11. Predict population characteristics from sample data. [C, CN]	**General Outcome** Explain the use of probability and statistics in the solution of complex problems. **Specific Outcomes** 8. Recognize that decisions based on probability may be a combination of theoretical calculations, experimental results and subjective judgements. [PS, R] 9. Demonstrate an understanding of the role of probability and statistics in society. [C, CN] 10. Solve problems involving the probability of independent events. [PS, T]

VI. GENERAL OUTCOMES, AND SPECIFIC OUTCOMES WITH ILLUSTRATIVE EXAMPLES (K–9)

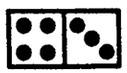
This section elaborates on the general outcomes and specific outcomes by providing illustrative examples, by grade, for the K–9 program. Note that the specific outcomes and illustrative examples for the Grade 10 to Grade 12 program will be developed at a later date.

CODING FOR ILLUSTRATIVE EXAMPLES (IEs)

The illustrative examples (IEs) listed on the following pages are organized by grade and have been correlated to specific outcomes (SOs). The coding used recognizes that IEs relating to more than one SO are listed before those relating to only one SO. Examples of the coding system are listed below.

1–4	Means that the IE relates to specific outcomes one through four in the subsection being addressed.
1, 3	Means that the IE relates to specific outcomes one and three in the subsection being addressed.
1, 3.1 1, 3.2	Means that the IEs relate to specific outcomes one and three in the subsection being addressed and that there are two of them.
6.1	Means that the IE relates to specific outcome six in the subsection being addressed.
4.1 4.2 4.3	Means that the IEs relate to specific outcome four in the subsection being addressed and that there are three of them.

KINDERGARTEN
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, orally, and compare quantities from 0 to 10, using number words in daily experiences.	1. Count the number of objects in a set (0 to 10). [CN, V]	1–2 Turn over two dominoes. How many dots in all on this domino? And this one? How many dominoes can you find with five dots? How many dominoes have the same number of dots as this one?  1–4 Set out a red plate, a blue plate and a green plate. Take a large handful of tiles, and place them on the desk. Count out seven tiles and put them on the red plate. Count out five tiles for the blue plate. Does the red plate have more tiles or does the blue plate have more? Tell me how you know this. Now count out two tiles for the green plate. Does the blue plate have fewer tiles than the green plate? Why or why not? Use the calculator to show the number of tiles on the red plate. . . . the blue plate. Put the red and blue plates in order from the least tiles to the most tiles. 1.1 Count the fingers on one hand. 1.2 How many ears on three people? 1.3 Take six books off the shelf. 1.4 Count the number of brushes on the chalkboard ledge. 1.5 Put eight plates around the table.
	2. Build and compare sets of objects and describe the relationships among them, using the terms; more than, greater than, fewer than, less than, the same as and equal to (no written symbols). [C]	2.1 Put out the same number of spoons as plates. How do you know you have an equal number of spoons and plates?
	3. Order up to 2 sets of like objects based on the number of objects in each set. [PS]	3.1 Spill a tub of unequal amounts of red and blue cubes. Sort the cubes by colour. How many cubes of each colour are there? Arrange the sets of cubes in order from least to greatest.

KINDERGARTEN
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, orally, and compare quantities from 0 to 10, using number words in daily experiences.	4. Explore the representation of single-digit numerals, using a calculator or a computer to represent numerals on a screen. [PS, R, T]	4.1 Use the calculator to show me the number that matches: – how old you are – how many thumbs you have – the number of people in your home.

KINDERGARTEN
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate awareness of addition and subtraction.	5. Represent the processes of addition and subtraction through role playing and the use of manipulatives. [C, CN, PS, V]	5.1 If two students are at the sand table and one more student comes over, how many students are at the sand table? 5.2 If two students are at the sand table, how many more students can join them, if six students can play? 5.3 Five students were building a fort. Two students left to have a snack. How many students are left at the fort? 5.4 Use your storyboard and counters to show this story. Three ducks are swimming on the pond. Four ducks are waddling on the sand. Tell me how many ducks in all. Two ducks fly away. How many ducks are left? Make up your own story for your storyboard and counters.

KINDERGARTEN
Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

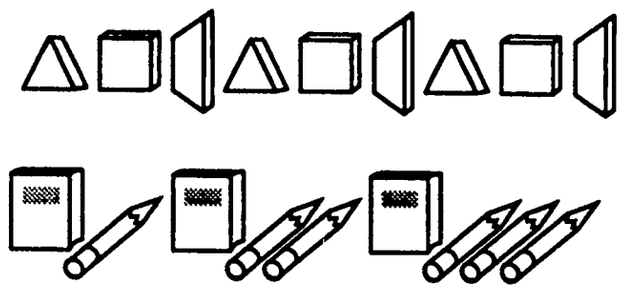
General Outcome	Specific Outcomes	Illustrative Examples
Identify and create patterns arising from daily experiences.	1. Sort objects, using a single attribute. [CN, R, V]	1, 3–4 Take a scoop of teddy bear counters (three sizes and three colours). Sort the bears. Use teddy bears from each group to make a pattern. Describe your pattern. Now use the coloured tiles to make a pattern sidewalk for the bears to sit on. Describe your pattern. 1.1 Take a scoop full of pattern blocks. – Sort out the red blocks. – Push the blocks back together. Sort out the blocks that are triangles. – Make up your own sorting rule. Sort the blocks by your rule. 1.2 Here are the large, thick attribute blocks. – Make a set of blue blocks. How many blocks are blue? – Push the blocks back together. Sort out the blocks that are shaped like circles. How many circles are there? – Push the blocks back together. Use your own rule to sort the blocks.
	2. Recognize and reproduce a pattern, using actions and manipulatives. [C, CN, PS, V]	2–4 Listen, and watch what I do. clap, slap, clap, slap, clap, slap – Copy what I did. – I have started a cube pattern. Does it match the clap, slap pattern? R G R G R G – Use more cubes to continue the pattern to the edge of the desk. – What is another way to describe the cube pattern?

KINDERGARTEN

Strand: Patterns and Relations (Patterns)

Students will:

- **use patterns to describe the world and to solve problems.**

General Outcome	Specific Outcomes	Illustrative Examples
Identify and create patterns arising from daily experiences.	3. Extend and create a pattern, using actions and manipulatives. [C, CN, PS, R, V]	3.1 Watch what I do. stamp, stamp, clap, stamp, stamp, clap, stamp, stamp, clap, . . . – Choose your favourite collection of counters. Build a pattern to match what I did. – What other actions could you do to match my pattern? Act out your action pattern.
	4. Describe, orally, a pattern. [C, CN]	4.1 Describe each of the patterns. Can you think of more than one way? What comes next in each of the patterns? tick, tock, tick, tock, tick, tock, . . . 

KINDERGARTEN
Strand: Shape and Space (Measurement)

Students will:

- **describe and compare everyday phenomena, using either direct or indirect measurement.**

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate awareness of measurement.	1. Classify and describe linear attributes of objects; e.g., long, short. [C]	1–2 Put these pencils in order from shortest to longest. How do you know this one is longest? Can you find a pencil that is longer than this one but shorter than that one? Explain.
	2. Arrange objects in order of size, by length or by height. [E, PS]	2.1 Use unifix cubes to make trains that are longer or shorter than a given train. 2.2 Which teddy bear is tallest? Which bear is shortest? Put the three bears in order from shortest to tallest.
	3. Cover a surface with a variety of objects. [PS, V]	3.1 Cover your book with coloured tiles. Try not to overlap the tiles or leave any holes in your covering. How many tiles are used? 3.2 Trace around your hand and cut out the tracing. Working with a partner, estimate how many hands would cover your desk; the teacher's desk; the door. Check each one to find out.
	4. Use the words full, empty, less and more, to talk about volume and capacity. [C]	4.1 Fill the pink cup with water. Is the pink cup empty or full? Spill some water from the pink cup. Does it have more or less water now? Put some water in the clear cup. Which has more water—the pink cup or the clear cup? 4.2 Put more sand in your plastic cup than I have in mine.

KINDERGARTEN
Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate awareness of measurement.	5. Use the words heavier or lighter, to talk about the mass (weight) of two objects. [C]	5.1 Lift and compare pairs of objects. Which object is lighter? Which is heavier? How can you check your thinking? Was your decision correct?
	6. Use the terms long time or short time, to talk about the duration of events. [C]	6.1 Have a race to determine which event takes more time: – tying shoes with laces or doing them up with some other type of fastener – zipping up a jacket or buttoning it.
	7. Use words like hot, hotter; cold, colder; warm, warmer; cool, cooler to talk about temperature. [C]	7.1 Which bowl of water is colder? 7.2 After skipping, is Robert's forehead warmer than Kristie's forehead?
	8. Exchange play money for objects in a play store. [E, PS]	8.1 How much does this sticker cost? Do you have enough pennies to buy one sticker? How do you know?

KINDERGARTEN
Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Sort, classify and build real-world objects.	9. Identify, sort and classify 3-D objects in the environment. [CN, R]	9.1 Given a group of objects (cans, cones, balls, glasses, etc.), sort and classify them. Explain your classification. Experiment to discover which objects will roll. 9.2 Choose one 3-D object. Where do you see this shape of object in our classroom? Our school? Our community?
	10. Describe, and discuss orally, objects, using such words as big, little, round, like a box, like a can. [C]	10.1 Reach into the bag and see if you can find the can/cylinder. How did you know you had found the can/cylinder? Reach in. Hold an object. Describe your object.
	11. Build 3-D objects. [PS, V]	11.1 Choose a 3-D object. What is your object called? Make your object, using molding clay, play dough or blocks.

KINDERGARTEN
Strand: Shape and Space (Transformations)

Students will:

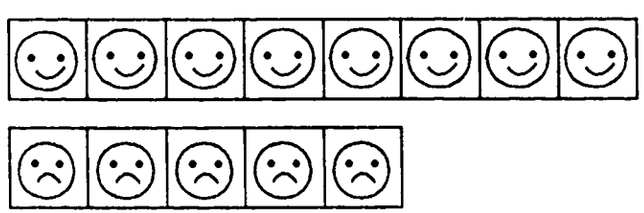
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, orally, the position of 3-D objects.	12. Describe the relative position of 3-D objects, using such words as over, under, beside, between, inside, outside. [C]	12.1 Simon says: . . . "put the longest pencil between the pen and the ruler." ". . . stand outside our circle but beside my desk." ". . . walk between the outlines of the square and the triangle." 12.2 Place the book under the chair. Set the box inside the circle. 12.3 Look at the cereal box in our play store. Tell me where to look for it.

KINDERGARTEN
Strand: Statistics and Probability (Data Analysis)

Students will:

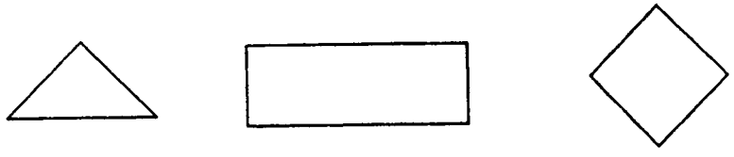
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect and organize, with assistance, data based on first-hand information.	1. Collect, with assistance, first-hand information. [C, PS]	1–3.1 Do Kindergarten children like french fries better than potato chips? – How can we find out the answer for our class? – How should we collect and write the class answer? – How could we show what we learned, using the graphing mat? – Does the graph show us that Kindergarten children like french fries or potato chips better? How? 1–3.2 Do you think most children like red best? Here is a pictolist of our class. You can visit each child and see if red is or is not his or her favourite colour. Remember to write down (or check) what each person tells you, (yes or no). Now use your red blocks and your white blocks, to show how many do and do not like red best. Do more children like red best? How do you know? 1–3.3 Bring your favourite bedtime buddy to school. Look at your classmates' buddies and talk about the differences. Is there more than one type? One colour? Size? How could we find out if there are more of one type than another? Sort buddies according to teady bears and other animals. Does one group have more/less? How many more/less? Organize the buddies into a 2-column real graph to show how easily we can now see how many more/less. What happens if we graph our buddies by colour? Size? Re-graph and discuss results.
	2. Construct, with assistance, a concrete/object graph, using one-to-one correspondence. [PS, V]	2.1 Sort the toys into two groups—those with wheels, and those with no wheels. Place all the toys with wheels on one bar of the graphing mat. Place all the toys in the other group on the second bar of the graphing mat. Can you tell which group has more? How?
	3. Compare data in two categories, using such words as more, less, the same. [C, CN]	3.1 Tell me what the pictolist shows. How do you know? Who likes swimming? 

Grade 1
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers from 0 to 100, and explore halves, in familiar settings.	1. Count orally by 1s, 2s, 5s and 10s to 100. [C, CN]	1–3 Here is a large set of counters. How many counters do you think there are? Count them. Count by 2s to make a set of 28. Count by 5s to build a set of 25. I've counted out 37 chips already. Finish the counting of a set of 50 for me. Order and compare the three piles of counters from least to greatest. 1, 6.1 Show the keys you must press on a calculator to make it skip-count by 2s to 20. Predict each number you will see in the display. Do the same for skip-counting by 5s to 50. Will it be faster to count by 2s or by 5s to 50? Why do you think this? How could you check? 1, 6.2 Show the keys you must press on a calculator to skip-count by 5s. Copy each number in order onto this adding machine tape (50 cm long). Stop when the tape is full. Tell me about any patterns you find in your numbers. 1.1 Count the number of eyes in the classroom by counting by 2s, and the fingers of the people at your table by counting by 5s or 10s.
	2. Estimate, then count the number of objects in a set (0 to 50) and compare the estimate with the actual number. [C, E, T]	2.1 Here is a jar full of marbles. Estimate how many marbles are in the jar. Count the marbles. How does your estimate compare with your actual count? Here is a different jar. Estimate how many marbles will fit inside this jar. Did the first jar help you to make your guess? Why or why not?
	3. Recognize, build, compare and order sets that contain 0 to 50 elements. [V] 4. Read number words to 10. [C]	3–4 Read the number on each card, and write the symbol in the blank below. a seven — a. _____ b ten — b. _____ c four — c. _____ d zero — d. _____ e eight — e. _____ f three — f. _____ Order these cards from the largest number to the smallest number.

Grade 1
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities.
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers from 0 to 100, and explore halves, in familiar settings.	5. Represent and describe numbers to 50 in a variety of ways. [C, PS, R, V]	5.1 Use the dominoes in one double-six set. Can you find two dominoes whose dots total 16? Can you find three dominoes whose dots total 16? Four dominoes? What will be the most dominoes you can use to make a total of 16 dots? 5.2 Show 23 in different ways, using these materials (blocks, beans, money). Show 23 in different ways, using pictures/diagrams. Show 23 in different ways, using numbers.
	6. Explore the representation of numerals (0 to 50), using a calculator or a computer to display numerals. [PS, R, T]	6.1 Which buttons do you have to push to show "13" on your calculator or computer screen? 23? 32? Four more than three? Three less than eight?
	7. Demonstrate, and explain orally, an understanding of halves as part of a shape or solid. [C, CN, V]	7.1 Share an apple equally with a friend. How much of the apple do each of you get? 7.2 Cut out these shapes. Show me how to find one half. Colour one of the halves of each shape.  7.3 Cut out another set of shapes. Find a different way to colour the halves. How do you know it is one half?

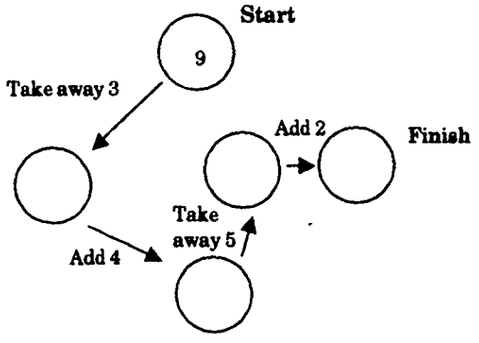
Grade 1
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply informal methods of addition and subtraction on whole numbers where the maximum sum is 18.	8. Use manipulatives and diagrams to demonstrate and describe the processes of addition and subtraction of numbers to 18. **Note:** memorization not intended. [C, PS, R, V]	8.1 Listen to this story. Don is going to the store for candies. He takes nine pennies from his piggy bank. His mother puts seven more pennies in his hand. – Is nine pennies part of Don's money or all of Don's money? Show me with your pennies. – Is mother's seven pennies part of Don's money or all of Don's money? Show mother's pennies. – What is the most money Don can spend at the store? Use the pennies to explain how you thought about the question. 8.2 Follow the directions given. Draw simple pictures to show what you did. Show 6 things. Add 3 more. How many in all? _____ Show 8 things. Take away 5. How many are left? _____ 8.3 Grandfather dropped four dollars in Eng-Hui's piggy bank for his birthday. Eng-Hui emptied his piggy bank and counted all his dollars. If he counts 13, how many dollars did Eng-Hui have before his birthday?

Grade 1
Strand: Number (Number Operations)
Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply informal methods of addition and subtraction on whole numbers where the maximum sum is 18.		8.4 Fill in all the blank circles as you move from start to finish.



8.5

+	8	6	5
4		10	
7	(15)		
3			8

Tell why the 15 belongs in its box. What about the 10? Choose any empty box. What number should be printed in the box? Why? Fill in all the other empty boxes.

−	15	9	18
7		(2)	
5	10		
9			9

Tell why the 2 belongs in its box. What about the 9? Choose any empty box. What number belongs in the box? Why? Fill in all the empty boxes.

8.6 9+6

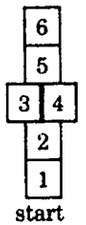
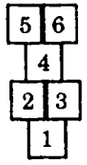
Draw and tell a story to match this number expression. How much is 9+6?

8.7 Tell me a story for 12−3. Draw me your story.

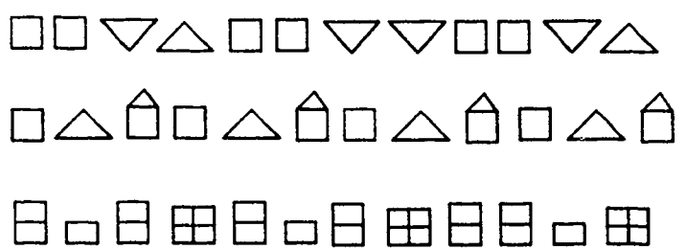
Grade 1
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply informal methods of addition and subtraction on whole numbers where the maximum sum is 18.		8.8 Five people chose chocolate milk for lunch, seven chose orange juice. How many more chose orange juice than milk? 8.9 Using 2-sided counters, "spill the beans", and tell how the beans landed; e.g., 4 red and 2 yellow. 8.10 Shahnaz's dad put some dimes in her piggy bank. Shahnaz knew she had six dimes but she recounts and finds 15 dimes in her bank. How many dimes did Shahnaz's dad put in her piggy bank? 8.11 Lisa had 17 dollars in her bank, but she took out ten dollars to help pay for a birthday present for her dad. How much money is left in Lisa's bank? 8.12 Pat donated five dollars to the Wildlife fund. Now he has just eight dollars left in his bank. How much money did he have before he gave away the five dollars? 8.13 If I cover half this domino, you will see only four dots. Altogether the domino has ten dots. Which domino am I thinking about? How do you know?

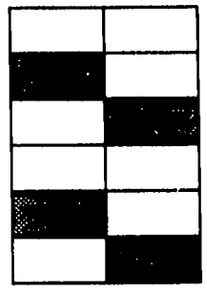
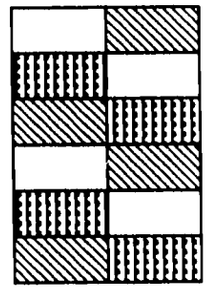
Grade 1
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create and compare patterns arising from daily experiences in the classroom.	1. Sort objects, using a single given attribute determined by the student. [CN, PS, V]	1–4 How could you sort the dinosaur collection into two groups? Why did you place these dinosaurs together? Does my dinosaur belong in your first group? Why? Use dinosaurs from both groups to build a pattern. Compare your pattern to someone else's. 1.1 Here is a collection of pattern blocks, two of each shape and colour. – Tell me one rule you might use to sort the blocks into exactly two groups. Sort the blocks by your rule. – How many blocks fit your rule? Without looking, tell me how many blocks there are in the group that do not fit your rule. How do you know? – Tell me a new rule for sorting the blocks. How many blocks fit your rule? How many do not?
	2. Identify, name and reproduce patterns, using actions, manipulatives, diagrams and spoken terms. [C, PS, R, V]	2–4 Here are two hopscotch patterns that have been taped out in your classroom. Compare the patterns. Hop out the pattern (one foot down, two feet down). Show the pattern, using snaps and claps. What square(s) would come next in each pattern? Make up your own hopscotch pattern.  start  start 2–3, 5 Look around the room. Describe one pattern you see. What actions might you use to act out the pattern? Show me. What: – counters, – pictures, or – words might you use to copy the pattern you see? Choose one, and show your pattern on paper.

Grade 1
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create and compare patterns arising from daily experiences in the classroom.		2–3 Use these blocks to show my pattern. clap clap stamp clap clap stamp clap clap stamp . . . 2.1 Is there a pattern? Circle any mistakes, and draw what you think will correct the problem. 
	3. Extend and create patterns, using actions, manipulatives, diagrams and spoken terms. [C, CN, PS, R, V]	3.1 Trace your hands to outline a pair of mittens. Use coloured markers to design a a pattern that covers your mittens.
	4. Compare patterns, using actions, manipulatives, diagrams and spoken terms. [C, CN, V]	4.1 How are these counting patterns the same? How are they different? 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, . . . 10, 20, 30, 40, 50, . . . How is counting by 2s like counting by 10s? How is it different?

de 1
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create and compare patterns arising from daily experiences in the classroom.		4.2 Describe Allan's pattern. Describe Jessie's pattern. How are these two patterns alike? What will happen next? (Next? Next?) in Jessie's pattern? Make a pattern that is different than Allan's or Jessie's pattern.  Allan  Jessie
	5. Begin to recognize patterns in the environment. [CN, PS, V]	5.1 What patterns have you seen on your way to school? . . . heard in our song about spring? . . . seen on your clothes? . . . seen on the floor in the school?

ade 1

Strand: Shape and Space (Measurement)

Students will:

- **describe and compare everyday phenomena, using either direct or indirect measurement.**

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and nonstandard units of measure.	1. Select an appropriate nonstandard unit to measure length. [R, V]	1.1 Use paper clips or chalkboard erasers to measure the length of a table top, the width of a door and the height of a chair. 1.2 Would it be better to use paper clips or chalkboard erasers to measure the length of a table top? Why? What about the length of a book? Why?
	2. Estimate, measure, record, compare and order objects by length, height and distance around, using nonstandard units. [E, PS]	2.1 Estimate the length of string it will take to go around this garbage can. Mark your guess with tape. Now check your estimate. Which was less—your guess or your measure? How do you know? 2.2 Estimate how many "hands" a table is high, a door is wide, and a teacher's desk is long. Then measure (in hands). Record and order the results. 2.3 We need a paper bag long enough to trace 12 squares in a row. I'll set one square at this edge. Do you think the paper will be long enough? Why? Lay the tiles on the paper. What have you discovered?
	3. Estimate the number of uniform objects or shapes that will cover the surface of a design, and verify by covering and counting. [E, V]	3.1 Estimate how many cards you will need to cover your favourite book. Now cover the book and count the cards. Did you need more or less than your estimate?
	4. Estimate the number of irregular shapes that will cover a given area, and verify by covering and counting. [E, V]	4.1 Estimate the number of times you could fit your shoes on the boot rack. Try it. Tell what you discovered. Does it matter how you put your shoes on the boot rack? Tell what you found out.
	5. Estimate, measure, record and compare the volume/capacity of containers, using nonstandard units. [E, PS]	5.1 Estimate the number of soup cans full of water it will take you to fill the milk jug. Check your guess. Was your estimate about right?

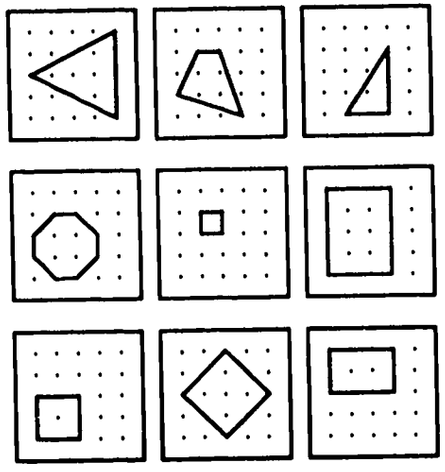
Grade 1
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and nonstandard units of measure.	6. Estimate, measure, record and compare the mass (weight) of objects, using nonstandard units. [E, PS]	6.1 Estimate the number of yellow hexagons you will need to balance the plastic geoboard. Measure and count to check your guess. Did you need more or fewer hexagons than you estimated? Find an object that you think will weigh less than the geoboard. How can you check your decision? Can you show me another way?
	7. Recognize that different objects may have the same mass (weight). [CN]	7.1 Use the balance scale to find two things that look very different but have about the same mass.
	8. Estimate and measure the passage of time related to nonstandard units. [E]	8.1 How many hand claps do you think it will take for you to complete: – the tying of a bow in your shoelace? – running around the gym? Check your estimates. Did you need more or fewer hand claps?
	9. Sequence events within one day and over several days. [R]	9.1 Use clothespegs to hang school activity cards in the order they will occur today.
	10. Compare the duration of activities. [E]	10.1 Is morning recess longer or shorter than: – a TV program? – a song?
	11. Describe the time of day; e.g., morning, afternoon. [C]	11.1 What time of day do we go home, when school is finished for the day? It's time for a snack! What time of day must it be?

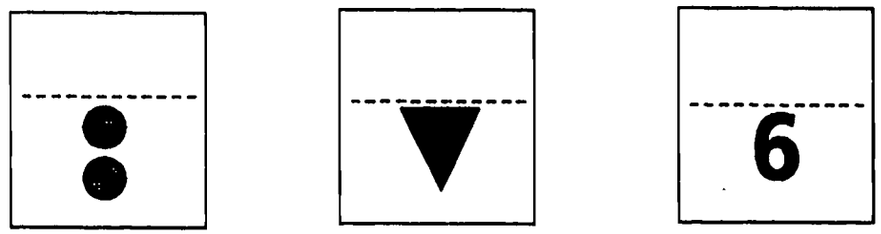
Grade 1
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and nonstandard units of measure.	12. Name, in order, the days of the week and the seasons of the year. [C]	12.1 What day comes after Tuesday? Before Sunday? What season follows spring? Comes before winter? 12.2 In which season do we plant gardens? Shovel snow?
	13. Describe and compare temperatures, using the senses. [C, E]	13.1 Is it warmer today than yesterday? How can you tell?
	14. Recognize and name coins; pennies, nickels, dimes, quarters, one dollar. [C] 15. State the value, in cents, of pennies, nickels and dimes. [C]	14–16.1 Given a coin collection: Sort the coins according to their value. Name the types of coins found in each set. Tell me the value of each type of coin. Show how many pennies equal one dime or one nickel. I want to pay for a 10¢ toy, show me on this chart three different ways to do it. Dimes | Nickels | Pennies | | | | | | | | | | | | 14–16.2 Find all the ways to show a given amount of money, and chart the results.
	16. Create equivalent sets of coins up to 10¢ in value. [PS, R]	16.1 This sticker costs 8¢. What coins can you use to pay 8¢? Can you show 8¢ another way? 16.2 Build a stack of coins equal in value to 10 cents. Can you build me another stack equal in value to 10 cents?

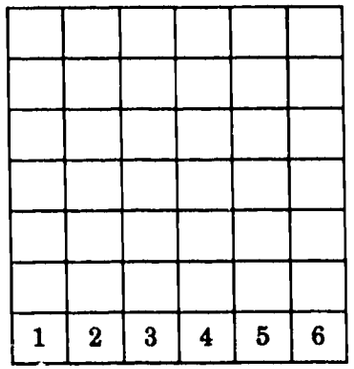
Grade 1
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Explore and classify 3-D objects and 2-D shapes, according to their properties.	17. Explore, classify and describe 3-D objects according to two attributes. [C, PS, R, V]	17–18 Look at this solid. Describe it. Use molding clay to build a copy of the solid. 17.1 Choose eight boxes and cans. Sort all the containers into exactly two groups. Tell me your sorting rule. I have this new container. In which group does it belong? Tell me why.
	18. Observe and build a given 3-D object. [E, PS, V]	
	19. Identify, name and describe specific 2-D shapes as: • circles • triangles • rectangles. [C, R]	19–20 Sort this collection of geodot shapes into two groups. Name each group. Find another way to sort the drawings. Identify each shape as a circle, triangle, rectangle or other. 
	20. Compare, sort and classify 2-D shapes. [CN, E, R]	

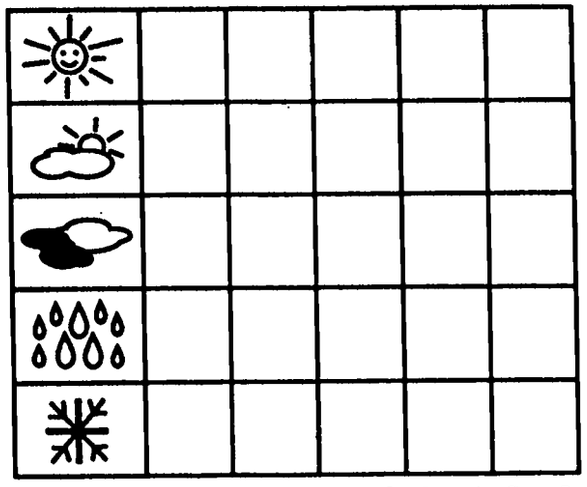
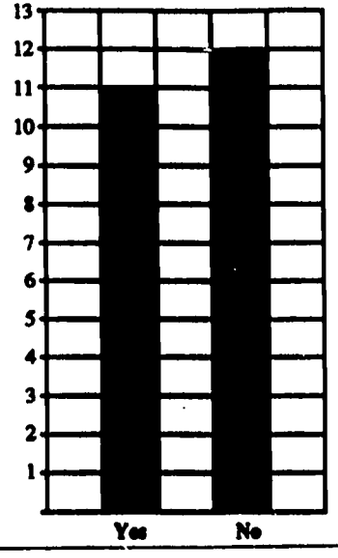
Grade 1
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, orally, the relative position of 3-D objects and 2-D shapes.	21. Describe the relative position of 3-D objects and 2-D shapes, using such words as near, far, left, right. [C]	21.1 Name one classmate who sits near to you on your left. Who sits far from you on your right? 21.2 I spy an object with a circular face. It is near the back of the room. What can it be?
	22. Match size and shape of figures by superimposing one on top of the other. [E]	22.1 Use a set of tangrams to find two pieces with the same shape that match in size. What shape have you used? How do you know they are the same size? What other pieces have the same size? 22.2 Find two boxes with faces of matching size. Tell me how you know they match. Find two cans with tops of matching size. Show me how you checked.
	23. Explore and describe reflections in a mirror. [CN, V]	23.1 Predict what you will see in the mirror, if you place it on the dotted line. Then test your predictions. 

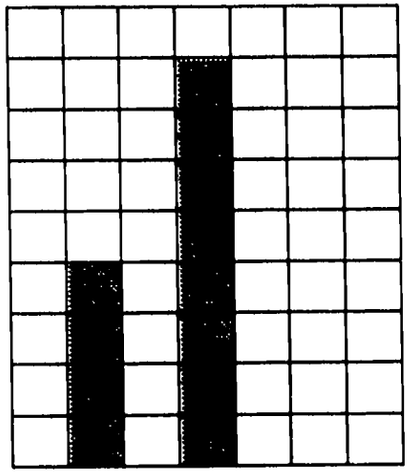
Grade 1
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect, organize and describe, with guidance, data based on first-hand information.	1. Collect, with guidance, first-hand information by counting objects, conducting surveys, measuring and performing simple experiments. [C, PS]	1–4.1 Which number appears most frequently when a die is tossed? Work in pairs. Colour in a square for each number that appears when a die is tossed, until one column is full.  1 2 3 4 5 6 Which number appears the most? The least? What questions can you ask about your results? 1–4.2 Do your classmates like vanilla, chocolate or some other flavour of ice cream best? – Survey each child and record each answer on the class list. – Use blocks on the graphing mat to show what you learned. – What are three things your graph shows about ice cream flavours? – Make up a question you might ask a friend about your graph. 1–4.3 What do you want to know about your classmates? How will you organize your information? How will you use the graphing mat to show what you have learned? What are two questions you can ask the class about your graph?
	2. Construct, with guidance, a concrete/object graph and a pictograph, using one-to-one correspondence. [CN, PS, V]	2.1 Here is a collection of 12 classroom books. How might the books be sorted into two groups? How could you use the graphing mat to show which group has more books in it?

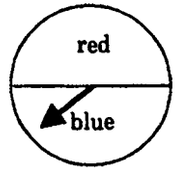
Grade 1
Strand: Statistics and Probability (Data Analysis)
Students will:
- **collect, display and analyze data to make predictions about a population.**

General Outcome	Specific Outcomes	Illustrative Examples
Collect, organize and describe, with guidance, data based on first-hand information.	3. Compare data, using appropriate language, including quantitative terms, such as how many more. [C, E]	2.2 Keep track of the weather each morning by completing the chart.  3–4 This is Marko's graph. He wanted to know if all his classmates have a dog for a pet. How many children did he survey? What did he learn? Do you have a dog? 

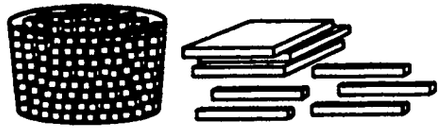
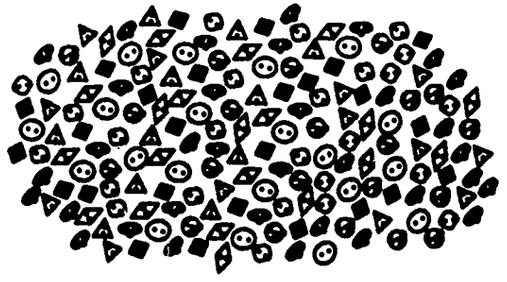
Grade 1
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect, organize and describe, with guidance, data based on first-hand information.	4. Pose oral questions in relation to the data gathered. [C, PS]	4.1 Tell what this graph might be showing. What needs to be written down before everyone can understand what the graph is showing? What is a question you might ask a classmate about this graph? Can you think of another question to ask? 

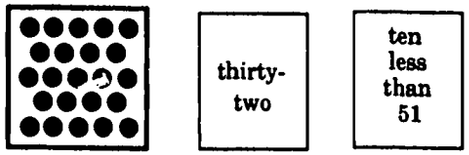
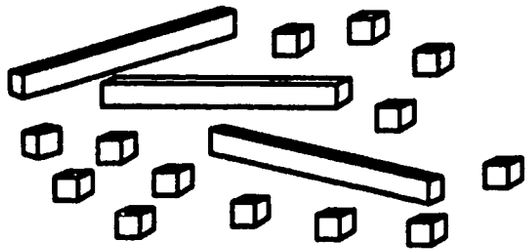
Grade 1
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Describe concepts of chance and chance events, using ordinary vocabulary.	5. Predict the chance of an event happening, using the terms never, sometimes, always. [C, R]	5.1 Look at the spinner. Then tell how often each statement will happen, using the words never, sometimes or always.  – The spinner will stop on red or blue. – The spinner will stop on green. – The spinner will stop on blue. 5.2 Fold a piece of paper into three equal parts. In one part, draw a picture of something that never happens. In the other parts draw something that sometimes happens or always happens. Explain. 5.3 Choose the card that belongs with these sentences. Explain your choice. – I close my eyes when I go to sleep. – I close my eyes when I play outside. – The sun will set in the evening. – There will be hot dogs for lunch. Never | Sometimes | Always

Grade 2
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	1. Count to 1000 by 1s, 2s, 5s and 10s, and to 100 by 25s, using starting points that are multiples of 1, 2, 5, 10 and 25 respectively. [C, CN] 2. Estimate, then count the number of objects in a set (0 to 100), and compare the estimate with the actual number. [C, E, PS, R]	1.1 Start at 250 and count by 10s to 400. 1.2 If you start at 150 and count on by 2s, will you say 165? Explain. 2–5 Estimate the number of unit cubes in the jar. Count to check your guess. How close was your estimate? Use the other base-10 blocks to show your number in two different ways. Draw a simple mathematical sketch of your number, using the fewest blocks possible. Write symbols to match your different representations.  2.1 How many chips can you pick up with one hand? Estimate and count to check. Write the numeral. Compare your number with those of your classmates. Arrange your chips to show the actual value of each digit in your numeral. 2.2 Estimate the number of buttons.  Circle groups of 10 to count. Compare your estimate with the actual count. Find another picture with many things to estimate and count. Test your skills.

Grade 2
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	3. Recognize, build, compare and order sets that contain 0 to 100 elements. [V]	3–6 Choose three word or numeral cards. Build a model of each quantity. Put them in order. What is the same about each? What is different? 3–5 Using chips, build a set to match each card.  What does "5" in 51 mean? What does the "1" mean? Arrange the chips so it is easy to count the total in each set. Which set has the most chips? How do you know?
	4. Represent and describe numbers to 100 in a variety of ways. [C, PS, R, V]	4–5.1 What number is shown by these blocks?  Build and draw the same number using: - more blocks - fewer blocks.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	5. Demonstrate, concretely and pictorially, place value concepts to give meaning to numbers up to 100. [C, R, V] 6. Round numbers to the nearest ten. [E]	4–5.2 Complete the chart, showing different ways of representing the number 43. 5–6 Estimate your height in unifix cubes. Work with a partner to build a train of cubes to match your height. Build your train so you can quickly count the cubes. Read the chart. On the last line, fill in your name, and your height in unifix cubes. Round each child's height to the nearest ten cubes.

Tens	Ones	TOTAL
3		43
	23	43
0		43
		43

Name	Height in unifix cubes	Height to nearest ten
Dan	64	
Salhee	67	
Dawn	56	
Moses	72	

Grade 2
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	7. Read and write numerals to 100. [C, CN]	7–8 Write the numeral that represents: – three more than eleven – seven less than twenty – four plus five added to six.
	8. Read and write number words to 20. [C, CN, V]	
	9. Use ordinal numbers to 31. [C]	9.1 Here are the first nine cars in a pattern train. The first car is red, and the ninth car is yellow. R G Y R G Y R G Y Which cars are yellow? If the train continues for nine more cars, which cars will be green? What will be the colour of the twenty-fifth car? Tell why you think this? 9.2 Put the birthday cards in the order they will happen this month. 9.3 Today is the _____ day of the month.
	10. Explore the representation of numerals (0 to 100), using a calculator or a computer to display numerals. [PS, R, T]	10.1 Show the number "one hundred twenty-seven" on a calculator. 10.2 Enter these numbers in your calculator. (thirty-four, forty-three) (301, three hundred ten) (231, one hundred thirty-two) How are they alike? How are they different?
	11. Demonstrate if a number from 1 to 100 is even or odd. [C, CN]	11.1 Danetta says she builds two-row rectangles, using square tiles, to help her younger brother picture odd and even numbers. Use Danetta's method with exactly ten tiles. Is ten an even or an odd number? Now use eleven tiles. Is eleven an even or an odd number? Name three odd numbers greater than thirty, but less than forty. Explain how you know your numbers are odd.

Grade 2
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Recognize and apply whole numbers up to 1000, and explore fractions (halves, thirds and quarters).	12. Illustrate and explain halves, thirds and fourths as part of a region or a set. [C, R, V]	12.1 If each student in the class gets half an apple, how many apples will we need to buy? What happens, if each student gets only one fourth of an apple? 12.2 Construct a rectangle on a geoboard. How many ways can you find to divide your rectangle in half? Record each solution on dot paper. Build another rectangle you can divide into thirds, and one where you can divide it into fourths. 12.3 Share a set of buttons equally among three people. Name three different sets that can have exactly the right number of buttons for each person to get one third of the total.

Grade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply a variety of addition and subtraction strategies on whole numbers to 100, and use these operations in solving problems.	13. Use manipulatives, diagrams and symbols to demonstrate and describe the processes of addition and subtraction of numbers to 100. [C, R, V]	13.1 Use numbers to describe and solve this story. Kwame has six pattern blocks. Yvette has eight more blocks than Kwame. How many blocks does Yvette have? 13.2 Use counters to explain how you think as you find the answer to this story. Rod has four loonies. Brad knows he has saved nine loonies. How many more loonies will Rod need to save to have as many as Brad? 13.3 Draw a picture that shows how you imagine this story. Kayla has 17 nickels. Darcy knows that if she saves 8 more nickels, she will have the same number as Kayla. How many nickels must Darcy have now?

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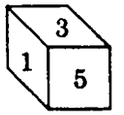
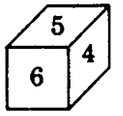
Grade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply a variety of addition and subtraction strategies on whole numbers to 100, and use these operations in solving problems.	14. Apply and explain multiple strategies to determine sums and differences on 2-digit numbers, with and without regrouping. [C, PS, R]	13.4 Use counters, pictures or numbers to show how you think about the question in this story. Hiroko and her brother are playing a game. Hiroko's marker is sitting on nine. Her brother's marker is sitting on 16. How many more points does her brother have? 13.5 Use counters, pictures or numbers to show how you think about the question in this story. Jinji has six dollars. His sister had eighteen dollars, but she bought a present for Jinji. If she now has as much money as Jinji, how much money did she spend? 13.6 Use counters, pictures or numbers to show how you think about the question in this story. Erica has three dollars. Dianne paid fourteen dollars for groceries, so she now has only as much money as Erica. How much money did Dianne have before she bought the groceries? 14–15 $27+19$ Manuel says he does this arithmetic by imagining that he should add 10, then another 10, and then remove one. Explain what he means. What is the sum? Use Manuel's method to add: $39+19$. What other method could you use? How could you change Manuel's method to solve these: $68+21$ $48-19$ 14.1 Read and solve the story problem. Russ has three dimes and five nickels in his pocket. How much more does he need to pay for a chocolate bar that totals 78¢ with taxes? Explain how you got your answer.

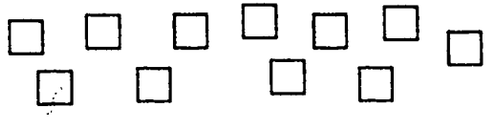
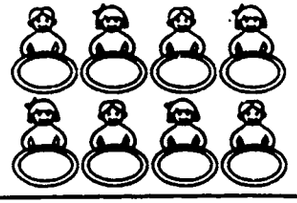
Grade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use an appropriate calculation strategy or technology to solve problems.	15. Apply a variety of estimation and mental mathematics strategies to addition and subtraction problems. [E, PS, T]	15.1 Aidon says he knows six, and seven more, is 13 because he always uses doubles to help his thinking. 6+7 is 6+6+1. That is 13. How would Aidon solve these expressions? 8+9 6+8 11+10 15.2 Camara imagines using a metre stick to help her estimate an answer. 93 – 48 "First, I mark the two numbers. Then I slide my fingers to the nearest tens . . . 50 and 90. Last, I count on by tens, . . . 60, 70, 80, 90, . . . that's 4 tens. The answer is about 40." Use a metre stick to explain how Camara would estimate an answer for this expression: 74 – 28 What other method could you use to estimate: 57 – 19 ?
	16. Recall addition and subtraction facts to 10.	16.1 Roll two number cubes. Say the total for the numbers rolled. Show me how many sums you can roll and name in one minute.  

Grade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use an appropriate calculation strategy or technology to solve problems.		16.2 Turn over two cards. Say the difference between the two numbers. Show me how many differences you can turn over and name in one minute. 10 10 10 10 10 4 4 4 4 4 16.3 Danny says the INPUT-OUTPUT box rule is: [add 3] If the following numbers are fed in, what will Danny's output be? 4? 1? 6? If the rule is : [subtract 2] If the following numbers are fed in, what will the output be? 10? 5? 2? What must the rule be for these sets of numbers [?] 7 → 9, 4 → 6 [?] 4 → 1, 7 → 4

ade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use an appropriate calculation strategy or technology to solve problems.	17. Demonstrate the processes of multiplication and division, using manipulatives and diagrams. [C, PS, V]	17.1 Use the counters to show how many legs there are on three chairs Make up a story about equal groups. Act it out with counters. 17.2 Use tiles to show three sets of four. How many tiles did you use in all? Use the same total number of tiles to show groups of two. How many groups of two are there in 12? Can you find another way to arrange 12 tiles into equal groups? Suppose you had only 11 tiles. Are there many ways to arrange 11 tiles into equal groups? Show me.  17.3 Draw pictures to show: – 4 sets of 3 – 5 groups of 2 – 3 piles of 4. Which drawings have the same total? Draw more pictures that show equal sets for the same total. 17.4 Each plate holds four cookies. Draw how many cookies in all. There are eight children. Each child gets a fair share of the cookies. Draw the cookies each child gets. 

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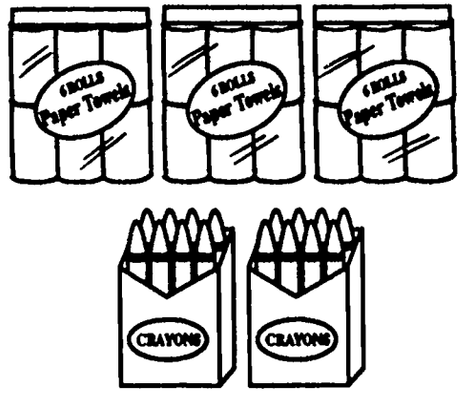
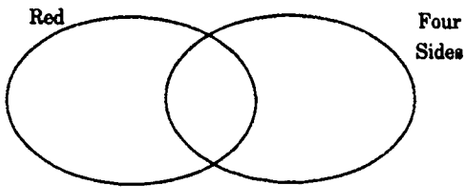
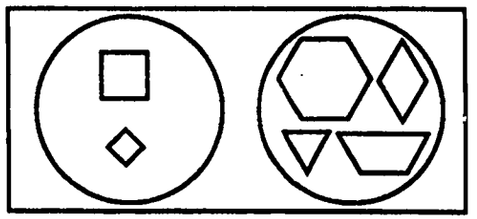
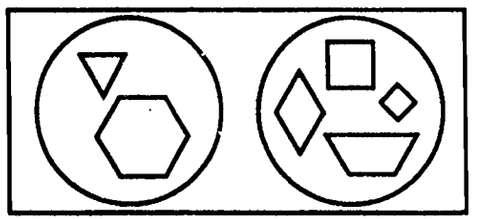
Grade 2
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

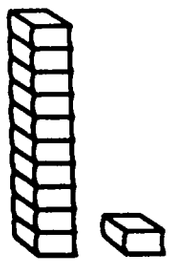
General Outcome	Specific Outcomes	Illustrative Examples
Use an appropriate calculation strategy or technology to solve problems.		17.5 Tony went shopping with his father. They bought three packages of paper towels and two packages of crayons. Each package of paper towels contains six rolls. Each package of crayons contains eight crayons. Use counters to show: – how many rolls of paper towels in all – how many crayons altogether.  Tony's father shares the paper towels fairly between the kitchen and the garage. Use your counters to show how many paper towels were placed in each place. Find pictures of other things that are sold in sets.

Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

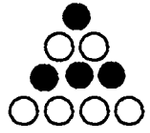
General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.	1. Sort objects and shapes, using one or two attributes. [CN, PS, V]	1.1 Use only the small attribute blocks. Sort the blocks according to these rules:  1.2 Sort attribute blocks. Record in your journal and tell why you sorted them that way. Sort the blocks another way. Record and tell why in your journal.
	2. Identify attributes and rules in presorted sets. [C, R]	2.1 Ron sorted pattern blocks.  Name Ron's sorting rule. He resorted the blocks.  What might be Ron's new sorting rule?

	Thin	Thick
Blue		
Not Blue		

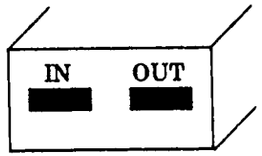
Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.	3. Identify and describe patterns, including numerical and non-numerical patterns. [C, CN, PS]	3–4.1 Study this pattern. ★!★★!★★★!★★★★! How might you use the following to represent this pattern: – linking cubes – body actions – pictures – sounds. Choose one. Record your work on a strip of paper as long as your arm. 3–4.2 "Anno's Counting Book" shows "one" like this: It shows "eleven" like this:  How might Anno show twenty-one? Why? Draw pictures to show 2, 22 and 32. Show patterns for other numbers.

Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- **use patterns to describe the world and to solve problems.**

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.		3–4.3 Dana is using two colours of counters to build a pattern that "grows and grows".  What is the name of the shape Dana is making? What will Dana do next to continue the pattern? Build Dana's shape and continue the pattern for three more rows. Name the number of counters in each dark-coloured row. What is the same about these numbers? What other patterns can you see in this arrangement? 3.1 Colour the multiples of 2 on a hundred chart. Describe any patterns you see in your colouring. If you colour the multiples of 5 on another hundred chart, how will your charts look alike? How will they look different? 3.2 What numbers could belong in each blank or box? Explain why. 5, 10, 15, 20, ___, ___ ☐, ☐, 12, 15, 18, 21, ☐, ☐ 3.3 Find the mistake in this pattern: clap, snap, slap, clap, snap, slap, clap, slap, snap, clap, . . . Explain how your can fix the pattern.

Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.		3.4 Tony and Tim are playing "Guess My Rule" at the INPUT-OUTPUT box.  When Tony puts in 6, Tim puts out 9. As the game continues, this is what happens:

IN	OUT
6	9
2	5
10	13

What pattern do you see in the numbers? What is Tim's rule?

What pattern do you see in these numbers?

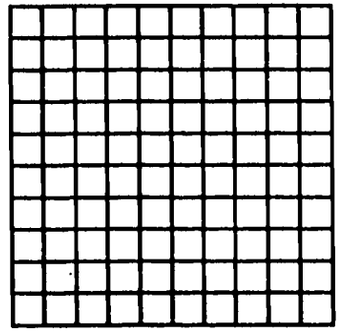
IN	OUT
8	3
11	6
6	1

What is the rule for this game?

Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.	4. Create, extend and describe patterns including numerical and non-numerical patterns. [C, PS, T, V]	4.1 Make a pattern. Describe your pattern in writing. Give your description to a classmate. Ask your classmate to reproduce your pattern. Was your description clearly understood by your classmate? 4.2 Bruno says he can make his calculator skip-count by pressing . . . Predict the first five numbers that Bruno will see on the calculator screen. Show them on the calculator. If you continue to press , will each of these numbers appear on the screen? Explain why or why not. 25? 32? 39? How would you program the calculator to skip-count by 5s? Predict three numbers greater than 50 that will appear on the screen. Predict three numbers between 30 and 50 that will not appear on the screen.

Grade 2
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Identify, create, describe and translate numerical and non-numerical patterns arising from daily experiences in the school and on the playground.	5. Translate patterns from one mode to another: manipulatives, diagrams, charts, calculators, words, symbols. [C, CN, T, V]	5.1 Penny printed the letters of her name in the squares of a 10 by 10 grid. Then she coloured the last letter of her name.  – Describe any patterns you see. Penny said her work is like a skip-counting pattern. What skip-counting pattern do you see in her work? – Predict the patterns you will see, if you write your name over and over in the squares of a 10 by 10 grid. Check out your prediction. 5.2 Transpose patterns to another medium: – concrete to concrete (unifix to toothpick) – concrete to pictorial (blocks to pictures) – letters to number (ABBA to 2442). Make a pattern. Write about your pattern. Give your written description to a classmate. Is your classmate able to make your pattern, after reading your description? If not, how could you make your description clearer?

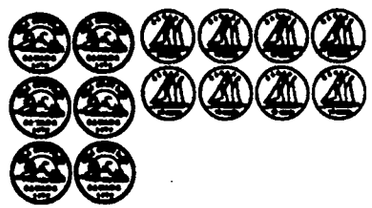
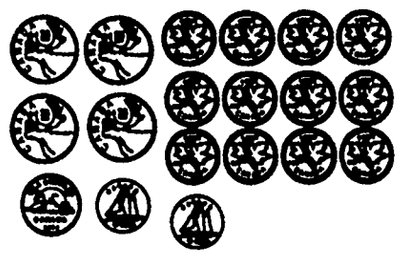
Grade 2
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using standard units for length and primarily nonstandard units for other measures.	1. Construct items of specific lengths (cm, dm, m). [E, V]	1.1 Snap together as many cubes as you need to make a train 25 cm long. Use a 30-cm ruler to check. Predict the number of cubes needed to make a train 1 m long. Explain your thinking. 1.2 Draw a line about 10 cm long, using a straight edge. What body part can you use to check the length of your line. Do you need to use a ruler to check?
	2. Select the most appropriate standard unit (cm, dm, m) to measure a length. [E, V]	2.1 Would you use metres or centimetres to measure: – the distance from your classroom to the school office? Why? – the length of your stride? Why?
	3. Estimate, measure, record, compare and order objects by length, height and distance around, using standard units (cm, dm, m). [E, PS]	3.1 Stand just behind a line and throw a cotton ball. Estimate the distance of your throw. Measure and record your distance in centimetres. Now get three friends to each throw a cotton ball. Use what you learned, from your own throw, to estimate each distance. Check your estimate by measuring. Record both the estimate and the measurement, in centimetres. Order the four measurements from least to greatest.
	4. Estimate, measure, record and compare the area of shapes, using nonstandard units. [E, PS]	4.1 Estimate the number of drink boxes needed to cover the face of a cereal box. Cover the box, and count the drink boxes. Will it take more or less hockey cards to cover the box? Why? Check and count.
	5. Construct a shape given a specific area in nonstandard units. [PS, V]	5.1 Using a geoboard, create as many shapes as possible with four squares. How many different shapes did you get?
	6. Estimate, measure, record, compare and order the capacity of containers, using nonstandard units. [E, PS]	6.1 Using different sized units, fill a container and count the number of units each time. Graph the results and explain why there are differences.

Grade 2
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using standard units for length and primarily nonstandard units for other measures.	7. Estimate, measure, record, compare and order the mass (weight) of objects, using nonstandard units. [E, PS]	7.1 Which is heaviest . . . a chalk brush, a box of staples or a rubber ball? Order the three objects from lightest to heaviest. Use yellow hexagon pattern blocks and a balance scale to find the weight of each object. Use your numbers to check your predicted order. Were your estimates correct? Explain.
	8. Recognize that the size and shape of an object does not necessarily determine its mass (weight). [CN]	8.1 Can something that is small be heavier than something that is large? Find two objects to demonstrate this, and use a balance scale to prove your thinking.
	9. Estimate and measure the passage of time related to minutes and hours. [E]	9.1 Estimate the number of time units you need for each activity: – minutes needed to watch a favourite video – hours you sleep on a weekend. Explain how to check each estimate.
	10. Select the most appropriate standard unit to measure a given period of time. [E, R]	10.1 Would you use minutes or hours to measure: – how long recess is – how long you sleep at night? Explain your answer.
	11. Name, in order, the months of the year. [C]	11.1 Name the month for each: – comes before March – comes after June – comes between October and December. Are you sure each answer is correct, or do you need to use a calendar to check?
	12. Relate the number of days to a week, months to a year, minutes to an hour, hours to a day. [CN]	12.1 Jorge says it is three weeks and two days to his birthday. How many days until his birthday? Explain how you know. Mira is 2½ years old. How many months since she was born? Explain your thinking. The video is 90 minutes long. Is that more or less than an hour? Explain.

Grade 2
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using standard units for length and primarily nonstandard units for other measures.	13. Read the date on a calendar. [C]	13.1 Use a calendar. What day of the week does each fall upon? – the 14th day of December – the 9th day of June. What is the date of each? – the 3rd Sunday in August – the 2nd Wednesday in April.
	14. Use a thermometer to determine rising and falling temperatures. [CN]	14.1 Use a thermometer to see the change in temperature as a container of hot water cools. How long do you think it will take for the water to reach 30°C.
	15. Create equivalent sets of coins, using pennies, nickels and dimes, up to $1 in value. [PS, R]	15.1 In Shel Silverstein's poem "Smart", the boy makes these trades: 1 dollar for 2 quarters . . . . 2 quarters for 3 dimes . . . . 3 dimes for 4 nickels . . . 4 nickels for 5 pennies. Fold a plain sheet of paper to make four equal parts. Draw the different sets of coins the boy should have traded for. Draw quarters in one part; dimes, nickels, and finally, pennies in the other three parts. Turn your paper over. Draw four other ways to mix coins to make one dollar.
	16. Estimate, count and record, using the cents symbol only, the value of collections of coins up to $1. [E]	16.1 Estimate the number of each type of coin that will fit on a "3 by 3" stickie note: pennies, nickels. Cover the stickie note and count. Record the total number of cents each time. 16.2 How much money in all?  
	17. Recognize and state the value, in cents, of a quarter, a dollar and bills to $10. [C]	

Grade 2
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

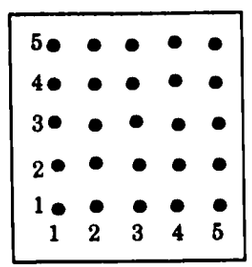
General Outcome	Specific Outcomes	Illustrative Examples
Name, describe and construct a variety of 3-D objects and 2-D shapes.	18. Explore faces, vertices and edges of 3-D objects. [R]	18.1 How many faces, vertices and edges does this object have? 18.2 Which empty containers in our classroom have a matching number of faces? Which 3-D solids? Do they also have the same number of edges and vertices?
	19. Identify, name and describe specific 3-D objects as: • cubes • spheres • cones • cylinders • pyramids. [C]	19–20 Select these 3-D solids from the collection: – cube – square prism (box) – sphere – cone – cylinder – pyramid. Keep only the cube, the square prism (box) and the square pyramid. Tell how they are alike, and how are they different. Choose one solid. Tell how many toothpicks and how many marshmallows you need to build a skeleton of your solid. Build the skeleton. How is this skeleton like the skeletons of the solids you did not choose? How is it different?
	20. Build a skeleton of a 3-D object, and describe how the skeleton relates to the object. [E, PS, V]	20.1 On a "geometry walk" in your neighbourhood recognize and identify the 3-D objects you see. 20.2 Use molding clay to build a solid box (prism). Use the toothpicks and marshmallows to build a skeleton of your box (prism). How many toothpicks did you need? Why? What about marshmallows? Why? Use your molding clay model to show what you mean.
	21. Build and rearrange a pattern, using a set of 2-D shapes. [E, PS, V]	21.1 Use pattern blocks of your choice to build an ABC pattern in one line across your desk. Rearrange your pattern so each ABC section fits under the first section built. How has your pattern changed? 21.2 Cut apart shapes and try to reassemble them from the pieces, or create new shapes. Explain to a partner, group or class what clues they used to help decide how the shape should be reassembled. Attribute/logic blocks or tangrams could also be used.

Grade 2
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

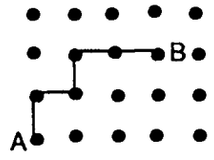
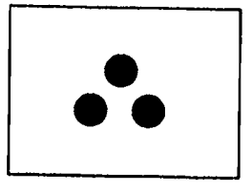
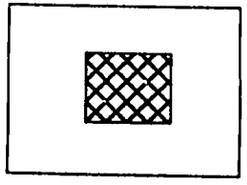
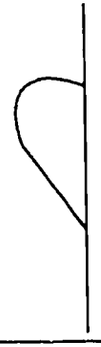
General Outcome	Specific Outcomes	Illustrative Examples
Name, describe and construct a variety of 3-D objects and 2-D shapes.	22. Match and make identical (congruent) 2-D shapes. [PS, T, V]	22.1 Fold a rectangular piece of paper to make two congruent shapes. Explain why they are congruent. Can you fold the rectangle a different way and still make two congruent shapes?

Grade 2
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Apply positional language, orally and in writing, to communicate motion.	23. Communicate and apply positional language in oral, written or numerical form. [C]	(Set up a screen between two students.) 23.1 Use up to 10 pattern block pieces to make a picture or a design. Give your partner the directions necessary to reproduce your design. Use as few directions as possible. Have your partner make the picture. Are you good at giving clear directions? 23.2 I made a shape on the geoboard. Follow these directions to make my shape: – Use one geoband to connect the first peg in the first row to the first peg in the third row. – Use another geoband to connect the first peg in the first row to the fifth peg in the third row. – Use the last geoband to join the third and fifth pegs in the third row. What shape did you make? Is it the same size and in the same place as mine?



Grade 2
Strand: Shape and Space (Transformations)
Students will:
- **perform, analyze and create transformations.**

General Outcome	Specific Outcomes	Illustrative Examples
Apply positional language, orally and in writing, to communicate motion.	24. Create symmetrical 2-D shapes by folding and reflecting. [PS, V]	23.3 Determine possible paths between two points *A* and *B* on a grid. Describe each path.  24.1 Use a mirror. Where do you place the mirror on each card to: – show all the lines of symmetry – show 6 circles – show 4 circles – show 2 circles. Can you find more than one way?   24.2 Fold a piece of paper in half. Show how to cut a heart, with one line of symmetry. Fold a piece of paper in fourths. Show how to cut out a flower, with 2 lines of symmetry. 24.3 Use a miraboard to complete the unfinished drawing. 

Grade 2
Strand: Statistics and Probability (Data Analysis)

Students will:

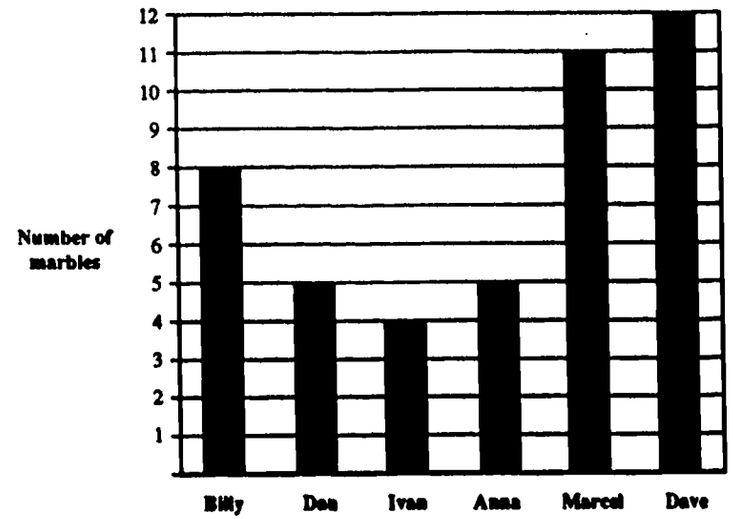
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect, display and describe data, independently, based on first-hand information.	1. Formulate the questions and categories for data collection, and actively collect first-hand information. [C, PS, R]	1–6 – What is one thing you would like to learn about your classmates? – Will you get your information by counting, by measuring or by survey? – How do you plan to keep a record of the information you gather? – Will you make a concrete, picto or bar graph to show your information? – Tell me how you plan to sort and graph your information. – Gather your information as you have planned, and show your information on a graph. – What can you learn by reading your graph? – Make up three questions you might ask a friend about your graph.
	2. Choose an appropriate recording method, such as tally marks, to collect data. [R]	1–3, 5–6 – Do you think the boys or the girls have more buttons on their clothes today? Why? – Ask each child to count how many buttons they have. Use a class list to keep a record of the numbers. – What will you do with your information to find if the boys have more buttons than the girls? – Do you think you will get the same answer tomorrow? . . . If you survey Grade 3?
	3. Organize data, using such graphic organizers as diagrams, charts and lists. [CN, PS]	3.1 The students in Room 10 conducted a mathematics experiment. Each person shook and spilled a pair of two different coloured counters. They recorded how the counters landed using R for red and Y for yellow. R, R R, Y R, Y R, Y Y, Y R, R R, Y Y, Y Y, Y R, R R, Y R, Y Y, Y R, Y R, Y Y, Y R, Y R, Y R, Y R, R R, R R, R Y, Y R, R – Organize and make a chart to show the results of the class experiment.

Grade 2
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect, display and describe data, independently, ~~based~~ on first-hand information.	4. Construct and label concrete/object graphs, pictographs and bar graphs. [PS, V]	4.1 Take a double handful of pattern blocks. – How would you sort the blocks to show groups of shapes with the same number of sides? – Build a graph so you can compare the number of blocks in each group. How would you label the graph? – Do we need to count the blocks to know which group has the most? Why or why not?
	5. Discuss data, and draw and communicate appropriate conclusions. [C, R]	5.1 Look at Billy's graph. – What do you think Billy wanted to learn about marbles? – Which student had: The most marbles? The least marbles? – How many more marbles does Dave have than Billy? How do you know? – Who has more, Dave or Anna? How many more? – How many students did Billy survey? How many were girls? Do you think Billy should have asked more girls? – Will Billy's graph look the same, if he gathers his information tomorrow? Next week?
	6. Generate new questions from displayed data. [C, R]	

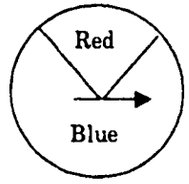
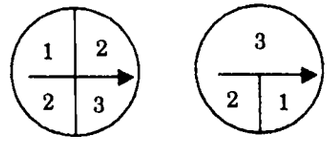
OUR MARBLES by Billy W.



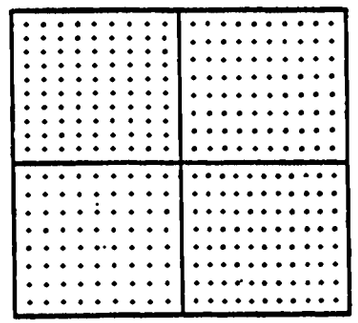
Grade 2
Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

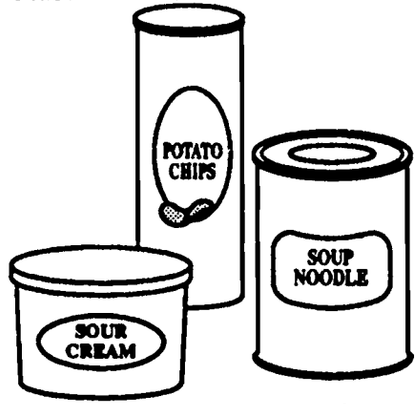
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Use simple experiments, designed by others, to illustrate chance.	7. Describe the likelihood of an outcome, using such terms as likely, unlikely, expect, probably. [C, R]	7.1 Choose a word: likely / unlikely / expect / or / probably to help explain the chances of each of these statements happening: – It will snow today. – We will have recess tomorrow. – Your parents will give you a bike for your birthday. – You will see a movie at home this month. – When you shake and spill 4 counters of two different colours, you will see only one colour. – When you roll a die, you will get a number greater than 1.
	8. Make a prediction based on a simple probability experiment. [E, PS]	8.1 Look at this spinner.  Is the spinner more likely to stop on red or on blue? Why? Keep a record of 20 spins. What does your experiment show about the spinner? If you record another 20 spins, what do you think will likely happen? Why? 8.2 Look at the spinners.  Tens Ones Will more numbers have 1, 2 or 3 tens? Why? Will more numbers have 1, 2, or 3 ones? Why? Spin 10 numbers. Record the results of the 10 spins. Why did you get more 23s than any other number?

Grade 3
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths).	1. Count by 2s, 5s, 10s and 100s to 1000, using random starting points. [CN]	1.1 Start at 91 and count by 2s. Stop when you say a number greater than 120. 1.2 Begin counting from 267 by fives. Stop after ten counts. What pattern helps you skip-count accurately? Predict the number you will say after ten more skip-counts. Test your prediction.
	2. Count by 25s to 1000, using starting points that are multiples of 25. [C, CN]	2.1 Travis has a five dollar bill and eleven quarters. He starts at 500 and skip-counts by 25s to find the total value of his money. What numbers will he say as he counts? What is his total?
	3. Estimate, then count the number of objects in a set (0 to 1000), and compare the estimate with the actual number. [C, E]	3.1 Estimate the number of dots in the diagram. How did you get your estimate?  Count the dots. Was your estimate close? 3.2 Estimate the number of beans in the jar. Write down your estimate. Count the beans, using a place value mat to display tens and ones. Record your number.
	4. Skip count backward by 2s, 5s, 10s and 100s, using starting points that are multiples of 2, 5, 10 and 100 respectively. [C, CN, T]	4.1 Mark programmed the calculator to skip-count backward from 125 by 5s. Predict the first ten numbers he will see in the display. Will he ever see zero in the display? Explain.

de 3
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths).	5. Demonstrate, concretely and pictorially, place value concepts to give meaning to numbers up to 1000. [C, R, V]	5–6.1 Brenda is using any five pieces, other than the large cube from a base-10 set, to build numbers. Her results are recorded in the chart below. Has she found all the possible numbers? H | T | O | Number | 5 | | 50 | | 5 | 5 | 3 | 2 | 32 | 1 | 4 | 14 Show how you would use any five pieces to make all possible numbers. Record your results. List the numbers from greatest to least. 5–6.2 Find three containers similar to the ones shown. Predict which container holds the most. The least.  Estimate the number of centicubes needed to fill each container to the top edge. Record your numbers. Fill each, and count the totals. Rebuild each total with the fewest possible base-10 blocks. Were your estimates about right? Did you correctly predict which container would hold the most? The least? What other method might be used to compare the capacity of the three containers?

Grade 3
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

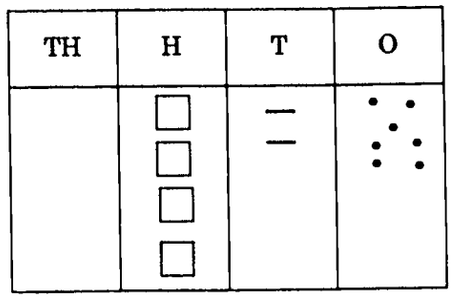
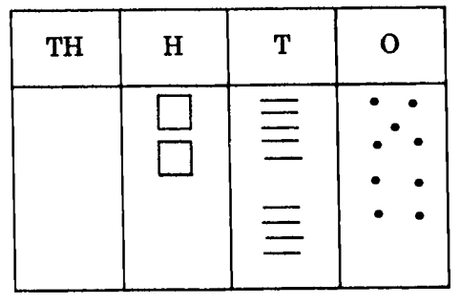
General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths).	6. Recognize, build, compare and order sets that contain 0 to 1000 elements. [PS, R, V]	5–6.3 Use base-10 blocks. Find several ways to show the number 257. Record each way you find with pictures. Complete the table for each way you find. Discuss how to build the number with the least amount of pieces.
	7. Round numbers to the nearest hundred. [E]	7.1 At Marg's school there are 276 students. How many packages of 100 jellybeans must be purchased so each student has one jellybean?
	8. Read and write numerals to 1000. [C, CN, V]	8–9 Here is a list of the top speeds animals can move over short distances. Rewrite each, changing numerals into number words, and number words into numerals.
	9. Read and write number words to 100. [C, CN, V]	Dolphin: fifty km per hour Elephant: 42 km per hour Dragonfly: fifty-nine km per hour Human: 46 km per hour Wild turkey: ninety-two km per hour. Which animals can move about forty km per hour over short distances? About fifty km per hour? Name three animals you think you can outrun.

H	T	O

Grade 3
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for whole numbers 0 to 1000, and explore fractions (fifths and tenths).	10. Use ordinal numbers to 100. [C]	10.1 Which is greatest: the 40th even number, the 10th number that ends in five, or the 20th number with at least one 2 in it. Orally explain your decision.
	11. Represent and describe numbers to 1000 in a variety of ways. [C, PS, R, T, V]	11.1 One way to make 90 is 45 + 45. Make 90 four other ways. 11.2 Marbles are sold in packages of 101, 41 or 34. If 900 are required for an experiment, which packages do you need to buy so you have the fewest left over? 11.3 Show 333, in several ways, on your calculator, without using the [3] key.
	12. Recognize and explain if a number is divisible by 2, 5 or 10. [C, CN, R]	12.1 Briana used a hundred chart to show which numbers can be divided into equal parts. Use a hundred chart to show the following: – numbers that can be divided into ten equal parts – numbers that can be divided into five equal parts – numbers that can be divided into two equal parts but not five equal parts – numbers that can be divided into 2, 5 and 10 equal parts.
	13. Illustrate and explain fifths and tenths as part of a region or a set. [C, R, V]	13.1 Look at the name below: JASON BLACKBERRY What fraction of the letters in the first name are vowels? Use grid paper to outline a rectangle that can be used to show the fraction of letters in the first name that are not vowels. Name the fraction and, using green, colour the part of the grid that shows the fraction. Repeat the activities for the last name. Do most names have a greater fraction of consonants than vowels? Report the findings of your investigation in your journal.

Grade 3
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply an arithmetic operation (addition, subtraction, multiplication or division) on whole numbers, and illustrate its use in creating and solving problems.	14. Use manipulatives, diagrams and symbols, in a problem-solving context, to demonstrate and describe the processes of addition and subtraction to 1000, with and without regrouping. [C, PS, R, V]	14.1 Paul and Gilbert are using a pair of dice and same base-10 blocks to play "Race to 1000". What is the number represented by the blocks on each boy's gameboard? Paul  Gilbert  The boys must show each new total, using the fewest blocks possible. Explain what each boy will do on his next turn. – Paul rolls 4 tens (1st die) and 6 ones (2nd die) – Gilbert rolls 6 tens and 3 ones Use numbers to record what happens on each boy's turn. 14.2 Gabriella wrote in her journal. 581 – 249 "To subtract 249 from 581, I add one to both numbers. Then the problem is easy to solve." Use base-10 blocks to explain Gabriella's subtraction method. What is the answer? What would Gabriella do with this question? 235 – 96 Show how you might use numbers and symbols to record your thinking.

Grade 3
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply an arithmetic operation (addition, subtraction, multiplication or division) on whole numbers, and illustrate its use in creating and solving problems.		14.3 Solve these story problems. Daniel's family took a car trip. The first day they travelled 325 kilometres. The next day they drove 25 kilometres more than the first day. How many kilometres did they travel altogether in two days? By the end of the third day, they had travelled 915 kilometres. How far did they travel on the third day? Daniel's father said the trip home would be seven hundred ninety kilometres, if they took a shortcut. How many kilometres can be avoided by taking the shortcut home? 14.4 Use the numbers 1 through 9, once only, to make a correct addition statement. Is there more than one solution? A B C + D E F G H J 14.5 In the story, *One Watermelon Seed*, Max and Josephine plant seeds in their garden: one watermelon; two pumpkins; three eggplants; four peppers; five tomatoes; six blueberries, seven strawberries; eight beans; nine potatoes, and ten corn. What could you do to find how many seeds in all were planted? Carry out your plan. What did you find? In the fall, Max and Josephine picked 10 watermelons, 20 pumpkins and 30 eggplants. The pattern continues. How many corn did they pick? What could you do to find how many fruits and vegetables they picked in all? Carry out your plan. What did you find?
	15. Use manipulatives, diagrams and symbols with maximum products and dividends to 50, to demonstrate and describe the processes of multiplication and division. [C, PS, V]	15.1 Draw a picture to show how thirty-three cookies can be shared equally by six children. 15.2 Mom bought three packages of muffins. Each package held one dozen muffins. She repacked the muffins before freezing them. Each freezer bag held three muffins. How many freezer bags did Mom use? Act out this story problem with counters. Write a number sentence to match this story. Make up your own two-step problem. Draw a picture to show the story and its solution. 15.3 Your younger brother is learning about operations with numbers. He doesn't understand what $5 \times 3 = 15$ represents. How would you explain this to him? (You may use pictures or graphs.)

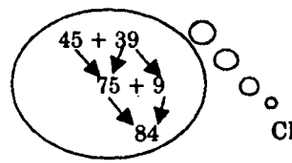
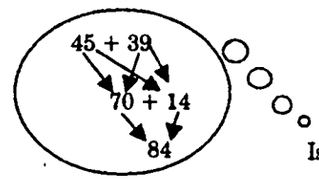
Grade 3
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply an arithmetic operation (addition, subtraction, multiplication or division) on whole numbers, and illustrate its use in creating and solving problems.	16. Recall addition/subtraction facts to 18 and multiplication facts to 49 (7×7 on a multiplication grid). [E]	16.1 Use the following grids to do addition and multiplication.
Use and justify an appropriate calculation strategy or technology to solve problems.	17. Verify solutions to addition and subtraction problems, using estimation and calculators. [E, PS, T]	17.1 How would you use estimation to decide if John's calculation is likely correct? 247 + 192 = 339 607 − 288 = 481 Do you agree with John's work? Explain. Recalculate any answer you estimate to be incorrect.
	18. Verify solutions to addition and subtraction problems, using the inverse operation. [PS, R]	18.1 Amy says she corrects her own calculations by adding to check subtraction and subtracting to check addition. Use Amy's strategy to check her work. 727 + 264 = 991 806 − 369 = 447 Do you think Amy's calculations are correct? Explain. Redo any calculations that are incorrect.

+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

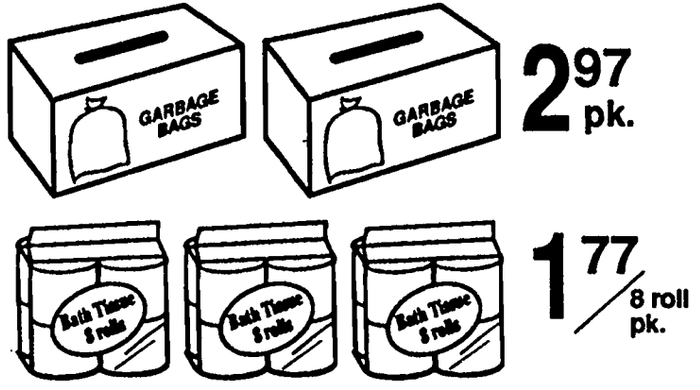
X	0	1	2	3	4	5	6	7
0								
1								
2								
3								
4								
5								
6								
7								

ade 3
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use and justify an appropriate calculation strategy or technology to solve problems.	19. Justify the choice of method for addition and subtraction, using: • estimation strategies • mental mathematics strategies • manipulatives • algorithms • calculators. [C, PS, R, T]	19.1 You wish to purchase a hamburger for $2.35, a drink for $0.95 and a cone for $1.75. You have a $5.00 bill. Will it be enough? Should you use estimation, a calculator or manipulatives? Explain your choice. 19.2 Chris and Ismail like to add numbers in their heads, but each has a different method.  Chris  Ismail Explain each method. Choose one. Use it to describe adding each of the following. 67 + 26 34 + 58 237 + 58

Grade 3
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use and justify an appropriate calculation strategy or technology to solve problems.	20. Calculate products and quotients, using estimation strategies and mental mathematics strategies. [E, R]	20.1 If you buy all the items pictured below, how much will they cost?



Arnie and Cindy estimated the cost as follows:

Arnie	Cindy
2×$2=$4	2×$3=$ 6
3×$1=$3	1×$2=$ 2
$7	1×$2=$ 2
	1×$2=$ 2
	$12

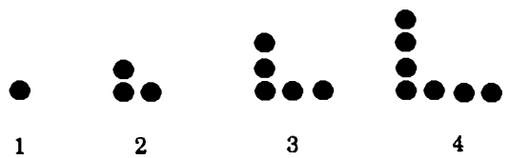
Explain each one's strategy.
Which strategy would you use? Why?
Use a calculator to find the exact cost.

The regular price for an 8-roll bath tissue pack is $2.10.
Arnie says they saved about $1.20 on the bath tissue.
Cindy says they saved about $0.90. Explain how each child arrived at an answer for the saving. Find the exact saving. Which estimation strategy provided the closer solution for the savings? Why?

Grade 3
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions.	1. Sort, concretely and pictorially, using two or more attributes. [CN, PS, V]	1.1 Write the numerals from 0 to 10 on separate scraps of paper. Sort them according to the rules given. Record your work using drawings and numbers.
	2. Use objects and concrete models to explain the rule for a pattern, such as those found on addition and multiplication charts. [C, R, V]	2–3.1 Make the next four shapes in this sequence.
	3. Make predictions based on addition and multiplication patterns. [PS, R]	Complete the table.

	Even	Odd
<5		
5 or >5		



Position	1	2	3	4	5	6	7	8
Number of counters	1	3	5					

How many counters will there be in the 12th shape? The 15th shape?

Grade 3
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions.		2–3.2 Look carefully at the numbers provided in the table. What number do you think belongs in the empty box on the top row of the chart? Why? What numbers belong in the empty boxes in the bottom row? Why? Complete the chart. You may use a calculator. Explain in writing what it tells you about spiders. Write a number sentence to show how to calculate the number of legs on six spiders.

Top row	1	2	3		5	6
Bottom row		16		32	40	

Grade 3
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions.		2–3.3 Describe the patterns you see in the rows, columns and diagonals of the addition chart. Draw an outline around any 2 by 2 square. Use addition to find another pattern. Can you find the same pattern in 3 by 3 squares? Draw an outline around any three numbers in a row or column. What is true about the middle number? Does this pattern work on any five numbers in a row or column? Report your discoveries in your journal.

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Grade 3
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions.		2–3.4 Look at the number pairs—7, 14; 11, 22; and 14, 28. What pattern do you see in the number pairs? Use the pattern to help you fill in the missing numbers. What pattern(s) helps you fill in the boxes in this example? Make up your own pattern, using addition or multiplication. Complete a matching chart. 2–3.5 Enter 17 on your calculator. Program the calculator to skip-count by 5s. Record the first five numbers shown on the screen. Predict the next five numbers. Check. What pattern do you see in the ones place? Tens place? Will each of the following numbers be in the counting sequence: 83? 100? 107? How can you check?

7	11	14	10		25	
14	22	28		18		32

1	2	3	4		6
	7	10	13	16	

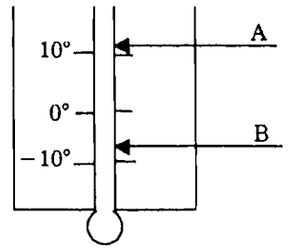
de 3
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and primarily standard units of measure.	1. Select the most appropriate standard unit, including km, to measure length. [E, R, V]	1.1 Olenka needs to measure the length of her classroom. She has a measuring tape that is only 150 cm long and is divided into mm, cm, dm and m. What unit should she use? Explain your reason. Use a measuring tape to measure the length of your room.
	2. Describe the relationships among cm, dm and m. [C]	
	3. Estimate, measure, record, compare and order objects by length, height and perimeter, using standard units. [E, PS]	3.1 Which is longest, the distance around the top edge of a waste basket, the perimeter of a chair seat or the length of the teacher's desk? Predict the measurement of each. Use a measuring tape to check your estimates. Were your estimates close?
	4. Select an appropriate nonstandard unit to measure area. [E, V]	4–5 Sheets of newspaper or used writing paper are available to cover the classroom floor before a painting lesson. Which size paper would be best to use? Why? Look at your classroom floor. About how many sheets of newspaper do you need to cover the floor? Explain your estimation strategy. How might you use only one sheet of newspaper to actually measure the floor? Measure and record the number.
	5. Estimate, measure, record, compare and order shapes by area, using nonstandard units. [E, PS]	
	6. Construct a variety of shapes given a specific area in nonstandard units. [PS, V]	6.1 You are given two congruent squares. Each square is one unit of area. Fold one square on the diagonal. Cut on the fold line. Describe the two new pieces. Use all three pieces to make different (noncongruent) shapes with an area of two square units. If only edges of the same length are placed together, how many different shapes with an area of two square units are possible?

Grade 3
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and primarily standard units of measure.	7. Select an appropriate object or nonstandard unit to measure capacity or volume of a container. [E, V]	7–8 You are to fill an ice cream pail with water. Which would be best to use to fill the pail—a cup, a spoon, a litre milk carton or a pop can? Explain. Now, using the measuring object chosen, carry out the task and record your findings in your journal.
	8. Estimate, measure, record, compare and order containers by volume/capacity, using: • nonstandard units • litres. [E, PS]	
	9. Estimate, measure, record, compare and order the mass (weight) of objects, using standard units (g, kg). [E, PS]	9.1 Fill three different empty tin cans with sand, such as a drink can, a soup can and a tuna can. Estimate the weight of each in grams. Use standard masses and a balance scale to check your estimates. Are you good at estimating mass? Explain.
	10. Construct objects to equal a given mass (weight). [PS]	10.1 Build a stack of books with a total mass of about 1 kg. Use a scale to check the mass of the stack. How does this help you to build a stack of books with a total mass of 5 kg? 10.2 Fill a plastic bag with about 250 g of plastic chips. Measure to check your estimate. How does the 250 g bag help you estimate the number of chips in 100 g?
	11. Estimate and measure the passage of time, using standard units; seconds, minutes, hours, days, weeks, months, years. [E]	11.1 Explain if you would use seconds, minutes, hours, days, weeks, months or years to measure: – how long it takes to count to ten – how old you are – the length of your favourite TV show.
	12. Read and write the days of the week and months of the year. [C]	

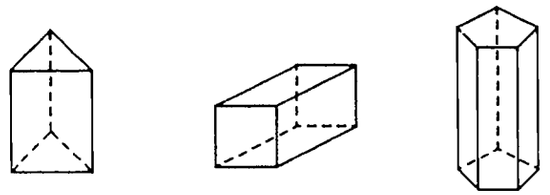
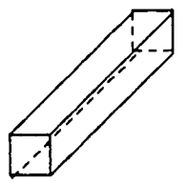
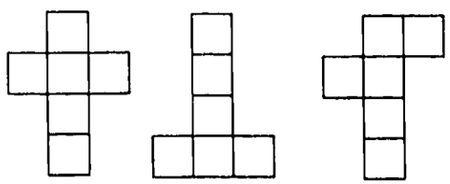
Grade 3
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and primarily standard units of measure.	13. Relate days to years. [CN]	
	14. Read digital clocks and write time to the nearest minute, using 12-hour notation. [C]	
	15. Estimate, read and record temperature to the nearest degree C. [E]	15–16 Study the thermometer. Print the temperatures indicated by arrows A and B. Research the high and low temperatures in your community last year. Draw a thermometer. Label and identify both the high and low temperatures. 
	16. Relate temperature to everyday situations. [CN]	16.1 Name a temperature that is about right for each: – viewing a movie at home – swimming in an outdoor pool – skating on an outdoor rink – calling the doctor, if you are running a fever.
	17. Create and recognize that a given value of money can be represented in many different ways. [PS, R]	17.1 How many ways can 40¢ be made, without using pennies? 17.2 Mom has 50¢, in nickels and dimes. There are more dimes. How many nickels does she have?
	18. Estimate, count and record collections of coins and bills up to $10. [E]	18.1 Imagine stacks of coins equal in height to your pointer finger. Estimate the number of coins, and the total value of each stack, if it is made of dimes, of quarters, of dollar coins. Build the stacks, using real money. Count, and record the number of coins and the value of each stack. Compare with each estimate. How does the length of your pointer finger compare to the length of a five dollar roll of dimes?

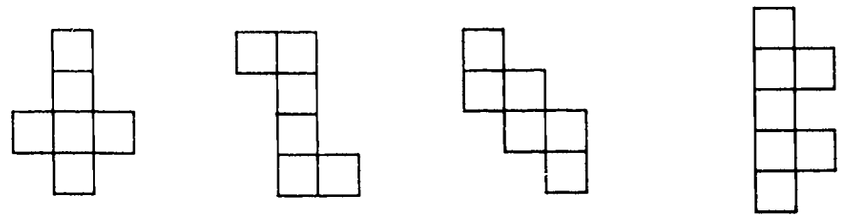
Grade 3
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using whole numbers and primarily standard units of measure.	19. Make purchases and change up to $10. [PS]	19.1 Dad pays for a $3.49 present with a ten dollar bill. Count back the change he should receive, beginning from $3.49. 19.2 I have more than a dollar in coins in my pocket, but I can't make change for a dollar. Which coins do I have in my pocket? Look for multiple solutions.
	20. Read and write both money notations (89¢ and $0.89). [C]	20.1 Ross had a dollar before he spent seventeen cents. Using numbers and symbols only, what are two ways to write the amount of money he has remaining?
	21. Recognize the value of bills up to $100. [C]	21.1 Look at Canadian bills. What is the value of the bill with a picture of: - a kingfisher? - an osprey? - a loon family?

Grade 3
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, classify, construct and relate 3-D objects and 2-D shapes.	22. Identify and count faces, vertices and edges of 3-D objects. [E]	22.1 Count the number of faces and vertices. Is there a pattern? Explain. 
	23. Identify and name faces of a 3-D object with appropriate 2-D names. [C, V]	23.1 Choose an assortment of objects and draw, trace or make prints of the faces. Identify and name the faces.
	24. Describe and name pyramids and prisms by the shape of the base. [C]	24.1 A pyramid has four triangular faces. What must be the shape of the base? 24.2 Identify the shape of the base, and name the prism. 
	25. Demonstrate that a rectangular solid has more than one net. [PS, V]	25.1 Cut out each of the following nets. Fold each one to make an object. What object does each net make?  Make a different net for the same object.

Grade 3
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, classify, construct and relate 3-D objects and 2-D shapes.		25.2 Cut out around these shapes. Which will fold into a box (cube)? Show me. 
	26. Compare and contrast two 3-D objects. [C, CN]	26.1 Use as many geometry words and ideas as you can think of to describe a table in your classroom. How is the table like the classroom door? How is it different? Choose two other objects to compare and contrast. 26.2 Which solids in a collection of 3-D objects have at least one pair of parallel faces? Describe the solids that are left out of the group.
	27. Recognize congruent (identical) 3-D objects and 2-D shapes. [CN]	27.1 Find two boxes which are congruent. How do you know that they are congruent? Identify two objects and two shapes in your classroom that are almost, but not exactly congruent. How do you know this?
	28. Explore, concretely, the concepts of perpendicular, parallel and intersecting lines on 3-D objects. [R, V]	28.1 Choose an appropriate empty container to demonstrate: - parallel faces/lines - perpendicular faces/lines - intersecting faces/lines.

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ade 3
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement

General Outcomes	Specific Outcomes	Illustrative Examples
Estimate ... compare ... number ... standard ... measure ...	...elect an appropriate object or ...erstandard unit to measure capacity ... volume of a container [E, V]	7–8 You are to fill an ice cream pail with water. Which would be best to use to fill the pail—a cup, a spoon, a litre milk carton or a pop can? Explain. Now, using the measuring object chose... carry out the task and record your findings in your journal.
	...timate measure, record, compare ... ...ler containers by ...capacity, using ... ...ndard units	
	... ..., compare	9–1 Fill three different empty tin cans with sand, such as a drink can, a soup can and a tuna can. Estimate the weight of each in grams. Use standard masses and a balan... to check your estimates. Are you good at estimating mass? Explain.
	... ...	9–1 Be ... ... Use ... the mass of the stick. How does this ... ...

Grade 3
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect first- and second- hand data, display the results in more than one way, and interpret the data to make predictions.		3–4 Aldo surveyed two Grade 3 classes to find their favourite movies/videos. This is his tally chart.

Movie/Video	Tally	Total
1st Favourite	𝍸 𝍸 |	
2nd Favourite	𝍸 𝍸 𝍸 |	
3rd Favourite	𝍸 𝍸 |	
4th Favourite	𝍸	
5th Favourite	𝍸 ||||	

Complete the tally chart.
How many children did Aldo survey?
How many children voted for the 2nd favourite? How many did not vote for the 2nd favourite? How are the two answers related?
Show the results of Aldo's survey on a bar graph.
Make a pictograph to show Aldo's information. Let one picture represent two votes.
Which graph do you think best shows Aldo's information? Explain your answer.
What five movies/videos do you suppose would be the favourites in your class?
Predict your tally, if you surveyed your class with your list of five favourite movies/videos. Carry out your survey.
Does your tally chart match your prediction? Why or why not?

4. Make predictions and inferences when solving similar problems. [CN, E, PS]

4.1 A magazine asked children to vote YES or NO to the question:
"Do parents and coaches care too much about winning?"

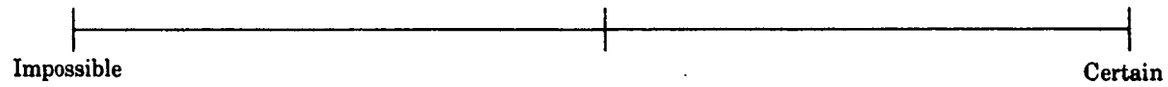
YES	NO
38	29

How many children were asked for their opinion?
How many more children said yes than no?
If twice as many children had been asked, about how many would have said YES? NO?
Predict what children in your class would say?
Conduct a survey to check your prediction.

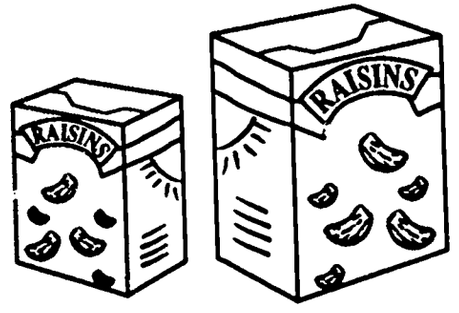
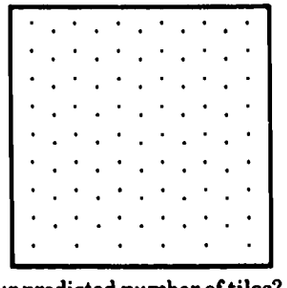
Grade 3
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect first- and second- hand data, display the results in more than one way, and interpret the data to make predictions.	5. Obtain new information by performing arithmetic operations on the data. [E, PS, T]	5.1 Five friends each recorded the number of minutes to get to and from school in one week. Ron 70 Dan 100 Juan 450 Beth 200 Dana 90 About how many minutes per day does each student spend getting to and from school? What might Juan say when he looks at the total time spent getting to and from school by his four friends? Why?

Grade 3
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Use simple probability experiments, designed by others, to explain outcomes.	6. Describe the likelihood of an outcome, using such terms as more likely, less likely, chance. [C, R]	6.1 Identify where each card provided belongs on the line below. Explain your placements.  You will read a book about an animal this week. The spinner will stop on green. You will have a birthday this year. A dog will fly.
	7. Conduct a probability experiment, choose an appropriate recording method, and draw conclusions from the results. [C, E, PS]	7.1 How many ways can 2 counters, of two different colours, land when they are spilled? Explain your answer with coloured drawings and compare your drawings with those of a classmate. If you spill the counters 10 different times, what colour combination would you expect to see most often? Why? Conduct an experiment to test your prediction. Keep a record of each turn. Was your prediction correct? Repeat your experiment two more times. Carefully keep records of your results. What is your conclusion?

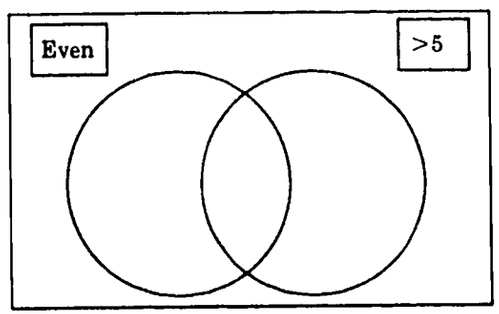
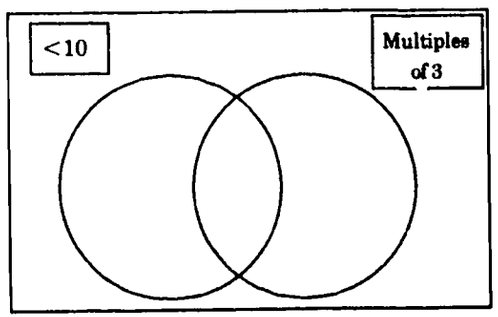
Grade 4
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions.	1. Estimate, then count the number of objects in a set (0 to 1000), and compare the estimate with the actual number. [C, E]	1.1 Estimate the number of raisins in a 14 g snack box. Check by counting, and find the difference between your estimate and the count. Use this information to predict the number of raisins in a 42 g snack box. Check. Was your estimate about right? Explain.  Suppose you could count the number of raisins in a 450 g box. About how many raisins would you expect to find? Explain your reasoning. 1.2 Estimate the number of holes in a ceiling tile as pictured below. Predict how many titles you will need to have a total of 1000 holes.  Count the holes. Do you need to adjust your predicted number of tiles? Explain why or why not.

Grade 4
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions.	2. Use skip counting (forward and backward) to support an understanding of patterns in multiplication and division. [C, CN]	2.1 Dear Mom, I can do division questions by counting multiples. Example, 54 ÷ 9 = □. Skip count by 9 . . . 9, 18, 27, 36, 45, 54 ① ② ③ ④ ⑤ ⑥ Six skips of 9 is 54 so 54 ÷ 9 = 6. Love Roxie. Use Roxie's method to solve these problems. 65 ÷ 7 = □ 6 × 8 = □
	3. Read and write numerals to 10 000. [R, V]	3, 5, 8 Use numerals to write the number that is: – three thousand greater than one thousand twenty-nine – one hundred ten less than eight thousand one hundred twenty-three – 1995 rounded to the nearest thousand.
	4. Read and write number words to 1000. [C, CN]	4–5, 8 Use words to write the number which is: – 150 less than 500 – 275 greater than 450 – 895 rounded to the nearest ten – 895 rounded to the nearest hundred.
	5. Compare and order whole numbers up to 10 000. [C]	5.1 Use digit cards from 0 to 9. Pick any four cards. Make the smallest possible 4-digit number. Make the largest possible 4-digit number. Make three more 4-digit numbers, and order them from smallest to largest.
	6. Demonstrate concretely, pictorially and symbolically place value concepts to give meaning to numbers up to 10 000. [C, V, R, T]	6.1 Dale's teacher asked him to build a model of two thousand one hundred thirty-four. Dale has these blocks on his desk: two large cubes, two flats, twenty-five small cubes. Can Dale build the model? Use diagrams and numbers to explain your answer(s).

Grade 4
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions.		6.2 Enter this number on a calculator: two thousand seventy-nine Without clearing this number: – change the zero to four – change the seven to nine – restore the original number in one step. Make up a similar problem. Show that your directions are correct.
	7. Represent and describe numbers to 10 000 in a variety of ways. [C, PS, R, V]	7.1 450 can be represented as 150×3. Represent 450 two more ways.
	8. Round numbers to the nearest thousand. [E]	8.1 The coastline of British Columbia is 7024.43 km long. Round to the nearest thousand kilometres.
	9. Sort numbers into categories, using one or more attributes. [CN, R]	9.1 Write the numbers from 0 to 12 on separate pieces of paper. Place each number in the Venn diagrams according to the rules shown. When your work is complete, write each number on the diagram.  

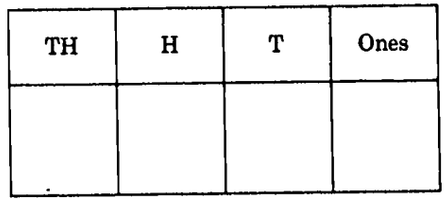
Grade 4
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 10 000, and explore proper fractions.	10. Illustrate and explain hundredths as part of a region or set. [C, R, V] 11. Connect proper fractions to decimals (tenths and hundredths), using manipulatives, diagrams and symbols. [CN, R, V]	10–11 Let the base-10 flat represent one whole square. Use centimetre cubes to build a one-layer shape that is less than one whole square. Record your shape on cm grid paper. Write a fraction and a decimal to tell how much of the square is covered by your shape. Is not covered by your shape.

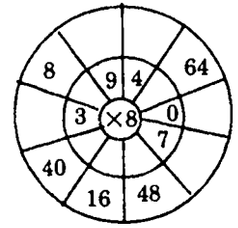
Grade 4
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers, and illustrate their use in creating and solving problems.	12. Use manipulatives, diagrams and symbols, in a problem-solving context, to demonstrate and describe the process of addition and subtraction of numbers up to 10 000. [C, PS, R, V]	12–13 Each week day a mail truck leaves the city post office to deliver mail to our town. The distance to the city and back to our town is one hundred thirty-four kilometres. Use base-10 blocks to show how you could represent the number of kilometres the mail truck travels each week. Show how you might use numbers to calculate the total number of kilometres travelled in one week. 12.1 A visitor from Mars arrives on your doorstep and is confused by the house number 631 he sees on your house. He asks you "Is 6 plus 31 equal to 631?" Answer his question and explain your answer.

Grade 4
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers, and illustrate their use in creating and solving problems.		12.2 Marnie is asked to show two thousand eight hundred fifteen. Show the number using base-10 blocks and in a place value chart.  Then Marnie drew the following three cards. Show the number in a place value chart Describe how Marnie might use the blocks to show how she subtracts the two numbers. Draw a picture of her answer.
	13. Demonstrate and describe the process of multiplication (3-digit by 1-digit), using manipulatives, diagrams and symbols. [C, PS, R, T, V]	13.1 Use a calculator to find whole numbers that divide evenly into 196. How many are there altogether? 13.2 Use a calculator to find two numbers whose product is 462. How many such numbers are there?

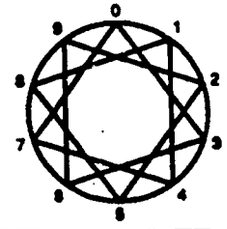
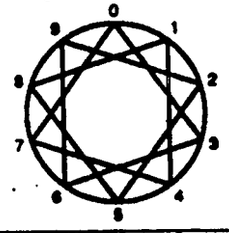
Grade 4
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers, and illustrate their use in creating and solving problems.	14. Demonstrate and describe the process of division (2-digit by a 1-digit), using manipulatives, diagrams and symbols. [C, PS, R, V]	14.1 $91 \div 7$ Make up a story problem to match this expression. Explain how you would estimate the quotient. Show how you would use base-10 blocks and numbers to calculate the quotient.
	15. Recall multiplication and division facts to 81 (9×9 on a multiplication grid). [E]	15–16, 18 In each row, circle the pair of numbers you would use to best estimate the product. Explain your choice. $27 \times 16 =$ 30×20 20×20 30×10 $33 \times 24 =$ 40×20 30×20 30×30 Use a calculator to compare each estimate to the actual product. Did you make the best choice? Use your strategy to best estimate 28×36. 15.1 Fill in the missing numbers. 

Grade 4
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use and justify an appropriate calculation strategy or technology to solve problems.	16. Verify solutions to multiplication and division problems, using estimation and calculators. [E, PS, R, T]	
	17. Verify solutions to multiplication and division problems, using the inverse operation. [PS, R]	17.1 Celine showed her division on the blackboard. How would you use multiplication to check her quotient? 7 ⟌ 92 35 | 5 63 35 | 5 32 28 | 4 4 | 14 R 4 Do you agree with Celine's solution? If not, how would you correct it?
	18. Justify the choice of method for multiplication and division, using: • estimation strategies • mental mathematics strategies • manipulatives • algorithms • calculators. [C, PS, R, T, V]	18.1 A piece of licorice is 19 cm long. Ginette wants to cut it into ten equal pieces. She uses a ruler and makes the first cut at 1.9 cm. Calculate where she will need to make the second cut. The third cut. Use a ruler to draw a diagram of Ginette's work. Label the points where she must cut the licorice. 18.2 Explain how you can find the answers to the following questions faster by using mental mathematics strategies rather than by using a pencil and paper algorithm or the calculator. $3 \times 204 = ?$ $56 \div 9 = ?$
Demonstrate an understanding of addition and subtraction of decimals.	19. Demonstrate an understanding of addition and subtraction of decimals (tenths and hundredths), using concrete and pictorial representations. [C, PS, V]	19.1 Show how you can solve the following problems, using base-10 blocks. – Diana bought a magazine priced at \$1.49 and a package of doughnuts priced at \$2.18. What was the total cost, before taxes? – Sam had a roll of paper 4.2 m long. After he cut off a piece to make a banner, there were 2.5 m left on the roll. How long was the piece he cut off?

Grade 4
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for, and predictions from, numerical and non-numerical patterns, including those found in the community.	1. Identify and explain mathematical relationships and patterns, using: • grids/tables/objects • Venn/Carroll/tree diagrams • graphs • objects or models • technology. [C, CN, PS, R, T]	1–2 Janice wrote in her journal about investigating circle patterns for multiplication facts. "I found the circle patterns for the multiples of three and seven are the same because the digits in the ones place are the same but are located by moving in opposite directions around the circle." Multiples of Three  Multiples of Seven  Investigate circle patterns for other multiplication facts. Can you find another pair of numbers whose multiples produce an identical circle pattern? Write a journal entry to explain your investigation. 1.1 Complete the Carroll diagram below by entering the whole numbers from 1 to 20, inclusive, into the correct squares.

0	1	2	3	4	5	6	7	8	9	10
0	3	6	9	12	15	18	21	24	27	30

0	1	2	3	4	5	6	7	8	9	10
0	7	14	21	28	35	42	49	56	63	70

	Greater Than 9	Less Than or Equal to 9
Even		
Odd		

Grade 4
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

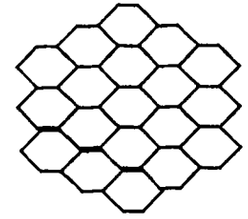
General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for, and predictions from, numerical and non-numerical patterns, including those found in the community.	2. Make and justify predictions, using numerical and non-numerical patterns. [C, PS, R]	1.2 Cliff, Emile and Azima each have a different favourite sport; basketball, skydiving, figure skating. Cliff and Emile do not like basketball. Emile is afraid of heights. What is the favourite sport of each person?

	Basketball	Skydiving	Figure Skating
Cliff			
Emile			
Azima			

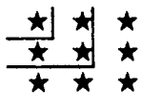
2.1 Bees made a honeycomb. They started on day 1 with the middle cell. Each day they added another ring of cells all around the honeycomb.

How many cells were there after the 7th day?

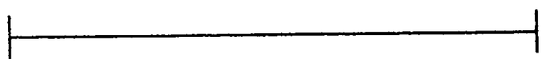
What was the first day on which there were more than 1000 cells?



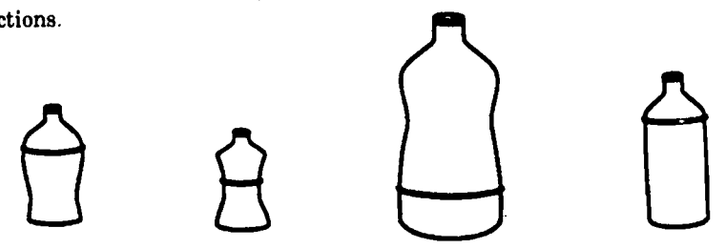
Grade 4
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Investigate, establish and communicate rules for, and predictions from, numerical and non-numerical patterns, including those found in the community.		2.2 This 3 by 3 array shows 3 groups of 3. ★ ★ ★ 3+3+3=9 ★ ★ ★ or ★ ★ ★ 3×3=9 The same array shows the sum of three odd numbers.  1+3+5=9 Use arrays to answer these questions: – Does a 4 by 4 array show the sum of four odd numbers? – Does a 5×5 array show the sum of five odd numbers? – Does this pattern continue? Why?

Grade 4
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using decimal numbers and standard units of measure.	1. Construct items of specific lengths, including mm. [E, V]	1.1 Look at the line segment provided. Estimate if it is more or less than 100 mm long. Add to, or subtract from, the line segment to make it 100 mm long. Explain what helps you make your estimate. 
		1.2 Use a ruler to draw a four-sided figure with a perimeter of 36 cm.
	2. Select the most appropriate standard unit to measure length. [E, R, V]	2–4 Measure a variety of items in the room. Make a list and record the measurements without the unit of measure. Exchange papers with a friend who must complete the list by adding the units; e.g., My pencil is 172 _____ long. My book is 0.8 _____ thick.
	3. Describe the relationships among mm, cm, dm, m and km. [C]	Prepare a second list changing the unit of measure. For example, measure the pencil in mm, and write: "My pencil is 172 cm long." Leave out the decimal point. The friend must decide where to place the decimal point.
	4. Estimate, measure, record, compare and order objects by length, height, perimeter and circumference, using standard units. [E, PS]	4.1 Choose five different empty cans. Include a pop, soup, juice and potato chip can, if possible. Estimate each can's height in mm and its circumference in cm. Decide which will be greater, the can's height or its distance around. Record all your estimates before measuring. How close were your estimated lengths. Were your predictions about height, circumference and the relationship correct?
		4.2 Create a board by using the following directions. Use blue cardboard to make a lake, which is a square of 30 cm per side. Cut and glue on to it: – a rectangular island (A) with a perimeter of 16 cm – a triangular island (B) with a perimeter of 18 cm – an irregular shape (C) with a perimeter of 25 cm – a circular shape (D) with a circumference of about 30 cm.

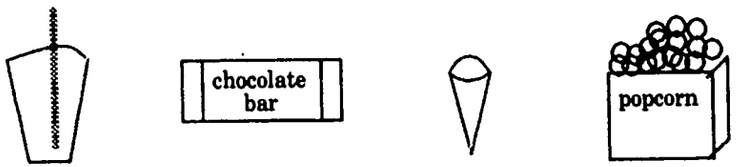
Grade 4
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using decimal numbers and standard units of measure.	5. Estimate, measure, record, compare and order shapes by area, using standard units (cm^2, m^2). [E, PS]	5.1 Trace your hand, your shoe, a paper bill, such as $2.00 or $5.00, a CD jacket, a telephone book cover and a computer disk. Estimate the area of each in square centimetres. Order your estimates. Use a sheet of clear acetate cm grid or a measuring tape to determine the area of each object. Compare your estimates and your order to your measurements. Tell how successful you are at estimating area.
	6. Construct a number of shapes given a specific area (cm^2). [PS]	6.1 What are the dimensions of all the rectangles with whole number sides that can be constructed having an area of 24 cm^2? Use grid paper to record each rectangle. 6.2 All seven pieces of the tangram puzzle can be arranged to form one large square. Make the square. Rearrange the pieces in the square to make a different quadrilateral, having the same area. What is the area?
	7. Select the most appropriate standard unit to measure area. [E, V]	7.1 Name two things whose area is best described in square centimetres and two shapes whose area is best described in square metres. Explain why.
	8. Relate the size of a unit to the number of units used to measure: • length • volume/capacity • area. [CN, R]	8.1 Murray says: "The larger the unit, the more you need to measure the area of a surface. So, the smaller the unit, the fewer you need." Use drawings, or examples, to prove or disprove Murray's conclusion.
	9. Estimate, measure, record, compare and order the capacity of containers, using standard units (mL, L). [E, PS]	9.1 The following plastic containers have elastic bands placed at different heights: a 750-mL cooking oil bottle, a 600-mL vinegar bottle, a 2-L drink bottle and a 1-L drink bottle. Estimate the number of mL needed to fill each container to the elastic band. Order your estimates. Find containers like the ones shown, and measure to check your predictions.  750 mL 600 mL 2 L 1 L

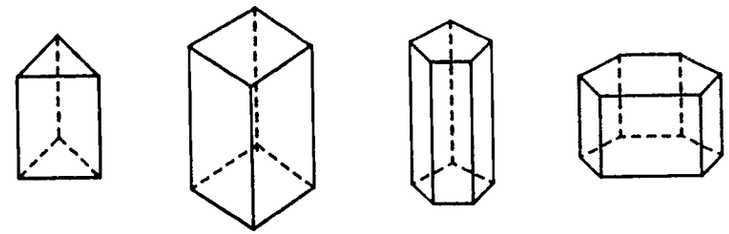
Grade 4
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using decimal numbers and standard units of measure.		9.2 Approximately how many litres of water does your bathtub hold? Describe how you estimated the answer.
	10. Describe the relationship between g and kg. [C]	10.1 There are three objects. Their weights are: 1950 g; 2020 g and 1590 g. Which object is closest to 2 kg? Explain your reasoning.
	11. Solve problems involving mass (weight), using g and kg. [PS]	11.1 Grade A large eggs weigh 56 to 63 grams each. A one dozen egg carton weighs about 50 grams. Denny says he's holding about 3 kilograms of large eggs. Explain how to find the number of full cartons of eggs Denny must be holding.
	12. Relate the size of a unit to the number of units used to measure mass (weight). [R]	12.1 Will it take more kilograms to balance a large tub of margarine, or more grams to balance a large tub of margarine? Give reasons for your answer.
	13. Relate years to decades; decades to centuries; centuries to millenniums. [CN]	13.1 Jill's great-grandmother was born in the first decade of the 20th century. What might have been her year of birth? Explain. The year 2001 will begin the 3rd millennium. Will you be living by the first year of the 4th millennium? Why or why not?

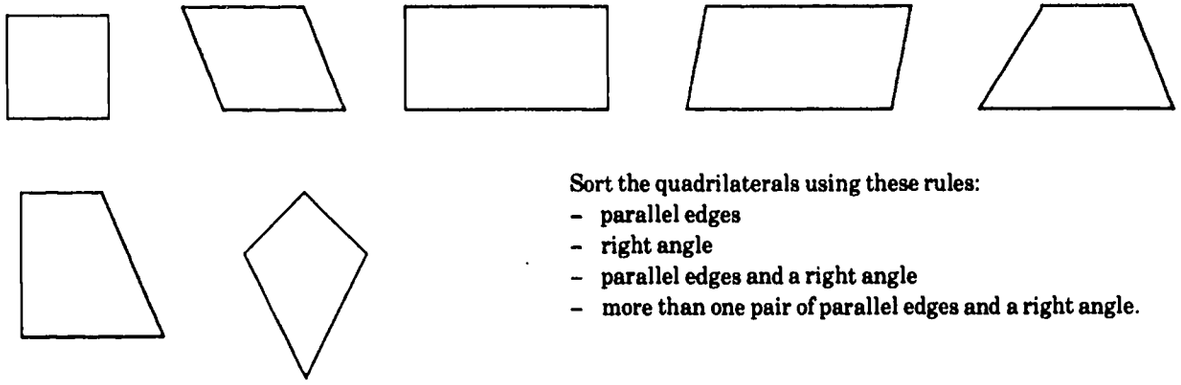
Grade 4
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Estimate, measure and compare, using decimal numbers and standard units of measure.	14. Read an analog clock to the nearest 5 minutes, and write time, using am and pm. [C]	14.1 Observe or research the following times. Record each time to the nearest 5 minutes, using numbers and symbols: – sunrise and sunset today – moonrise and moonset today – the arrival and departure of a boat, ferry, plane, bus or train in your community.
	15. Estimate, count and record collections of coins and bills up to $50. [E]	15.1 Estimate the number of coins in a cupful of pennies . . . nickels, dimes, quarters, dollar coins. Count each, and record its total value. How would knowing the value of a cupful help you estimate the total value of a jar full? A piggy bank full? Explain.
	16. Make purchases and change up to $50. [PS]	16.1 Iris is given $5.00, but she is only to spend up to $3.50. She is to buy at least one treat for her sister, brother and herself. What combinations of items can she buy? Count back the change she should receive from each possible purchase.  99¢ 69¢ $1.75 $1.19
		16.2 Kenryu paid for an item with two, twenty-dollar bills. His change was $8.32. What did the item cost? What coins and bills did Kenryu likely receive as change? Count back Kenryu's change, beginning with the cost of his purchase.

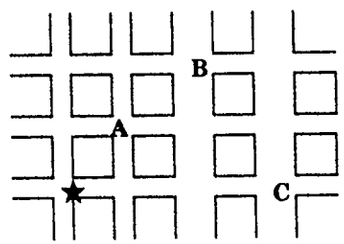
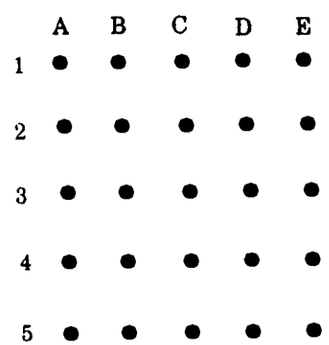
Grade 4
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, classify, construct and relate 3-D objects and 2-D shapes, using mathematical vocabulary.	17. Design and construct nets for pyramids and prisms. [E, PS, V]	17.1 Troy found there are 12 different nets that fold to make a cube. He concluded that a 3-D object will have twice as many nets as it has faces. Choose one pyramid and one prism. Find all possible nets for each. Is Troy correct? Explain.
	18. Relate nets to 3-D objects. [CN, V]	18.1 A net has five faces. What object might it produce when folded? Use drawings in your explanation.
	19. Compare and contrast: • pyramids • prisms • pyramids and prisms. [C, R]	19.1 Count the faces, vertices and edges for each of these prisms. Is there a pattern? 
	20. Recognize, from everyday experience, and identify: • point • line • parallel lines • intersecting lines • perpendicular lines • vertical lines • horizontal lines. [C, V]	20, 26 Demonstrate each step of the following activity on a 5 by 5 geoboard. Record each step on geodot paper. Outline the largest possible rectangle that is not square. Use an orange marker. Identify the number of points touched by the outline. Colour them brown. Place a geoband that is equal in length and perpendicular to a short edge but is not a line of symmetry. Use a yellow marker. Place a geoband that is equal in length and parallel to a short edge but is not a line of symmetry. Use a blue marker. Find a way to name and describe the location of the point where the perpendicular and parallel lines intersect. Colour it green. What fraction of the whole rectangle is each outlined part?

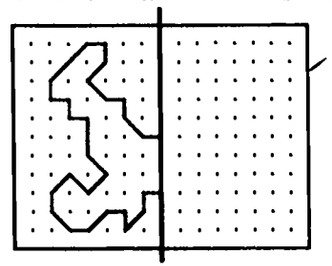
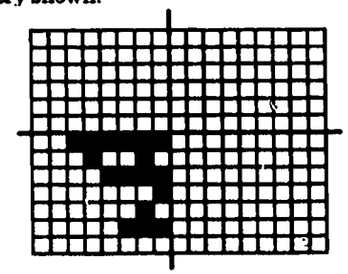
Grade 4
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Describe, classify, construct and relate 3-D objects and 2-D shapes, using mathematical vocabulary.		20.1 Find a black and white picture in a magazine, newspaper or colouring book. Do each activity: – find a vertical line, and colour it green – find a horizontal line, and colour it blue – find two other lines that are perpendicular and colour them red – find two different lines that are parallel, and colour them orange – find a point not already coloured, and colour it purple.
	21. Classify angles in a variety of orientations according to whether they are right angle, less than right angle, or greater than right angle. [E, V]	21.1 Demonstrate how to use a scrap of paper to create a right angle. Use your right angle to locate classroom objects with examples of the following angles: – an angle that is less than right – an angle that is greater than right – a right angle.
	22. Identify and sort specific quadrilaterals, including squares, rectangles, parallelograms and trapezoids. [R, V]	22.1 Name each quadrilateral:  Sort the quadrilaterals using these rules: – parallel edges – right angle – parallel edges and a right angle – more than one pair of parallel edges and a right angle.

Grade 4
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Use numbers and direction words to describe the relative positions of objects in two dimensions, using everyday contexts.	23. Communicate and apply terms of direction, such as north, south, east, west, and relate to maps and grids. [T]	23.1 On a simplified street map, locate special points of interest; e.g., store, school, mall, bridge; from a point of reference (home) ★. Describe the path from ★ to B, using directions, N, S, E, W. 
	24. Place an object on a grid, using columns and rows. [C, CN]	24.1 I am hiding at one of the points on the 5 by 5 geoboard. Use the numbers and letters to locate me in as few guesses as possible. 
	25. Trace a path, using oral or written instructions, and write instructions for a given path. [C, PS, T]	25.1 Write directions for going from your school to your home. Write directions to go from your home to your school. How are they the same? How are they different?

Grade 4
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Use numbers and direction words to describe the relative positions of objects in two dimensions, using everyday contexts.	26. Create and verify symmetrical 2-D shapes by drawing lines of symmetry. [PS, V]	26.1 Complete each picture, using the lines of symmetry shown.  1 line of symmetry  2 lines of symmetry

Grade 4
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect first- and second-hand data, assess and validate the collection process, and graph the data.	1. Select a sample or population, and organize the collection of data. [PS]	1–3 **How Tall Will I Be?**

The activities on this sheet allow children to complete information about height expectations and answer questions about the heights of family members. The table displays average heights for children. Family records might furnish data on a particular family. Other resources, such as an encyclopedia, an almanac, or the *Guinness Book of World Records* can yield interesting related information. Have fun with these real-life mathematics activities.

AVERAGE HEIGHT FOR CHILDREN

Boys		Girls	
Age in Years	Height in cm	Age in Years	Height in cm
2	96.2	2	95.7
4	103.4	4	103.2
6	117.5	6	115.9
8	130.0	8	128.6
10	140.3	10	138.6
12	149.6	12	151.9
14	162.7	14	159.6
16	171.6	16	162.2
18	174.5	18	162.5

Source: *Current Pediatric Diagnosis and Treatment 1987*, edited by C. Henry, M.D., et al. Norwalk, CN: Appleton & Lang, 1987).

Vital Statistics

My height at birth: __
at age six: __
My age today is: __
I am __ cm tall.
I am ___ cm taller than I was at age six.
I am taller/shorter than average (circle one).
I predict that my height will be __cm when I am fourteen.
I predict that my height will be __cm in ten years.

Predictions about Height

Use the table "Average Height for Children" to answer the following questions.

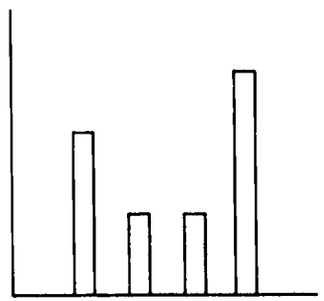
1. Would you say that most members of your family are tall or short? Explain you answer.
2. Ravi noted that he was 150 cm tall at age ten. Do you think he would be 300 cm tall at age twenty? Explain your answer.
3. Do you expect to be about average, taller than average, or shorter than average by age twenty? Explain your response.
4. How likely are you to grow to be over 160 cm tall? Explain your answer.
5. Make a bar graph comparing the heights of everyone living in your house. Order the heights according to the ages of the persons measured, beginning with the youngest.

Adapted from the *Arithmetic Teacher*, September 1991.

ıde 4
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect first- and second-hand data, assess and validate the collection process, and graph the data.		1.1 A Grade 4 class wants to learn if more families make popcorn at home in the microwave than by any other method. How might they word their question? Whom should they survey? Why? What method should they use to best keep their information organized? Explain with words and a drawing.
	2. Manipulate data to create an interval graph/table for display purposes. [PS, V]	
	3. Construct a bar graph and a pictograph, using many-to-one correspondence, and justify the choice of intervals and correspondence used. [C, T, V]	3.1 What might the following graph represent? Label the axes and show the scale(s) being used. 
	4. Discuss the process by which the data was collected. [C, R]	4.1 Shinobu and her brother were arguing if Grade 4 students would rather watch hockey or figure skating on TV. Shinobu asked the first 20 students in the morning. From the results, she decided about half the school would prefer watching hockey and half would prefer figure skating. Her brother Kelly asked 40 boys from Grade 4 and Grade 5. He concluded that all 200 students in the school would rather watch hockey on TV. Which person had the better plan for collecting good data? What would be a better way to collect this data?

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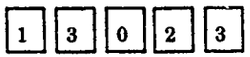
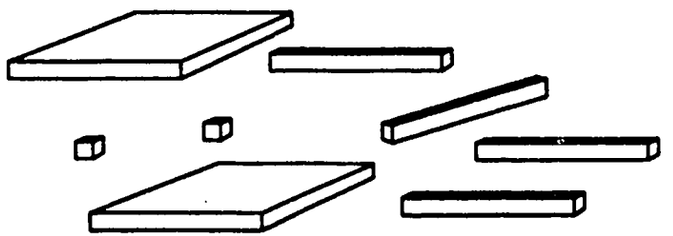
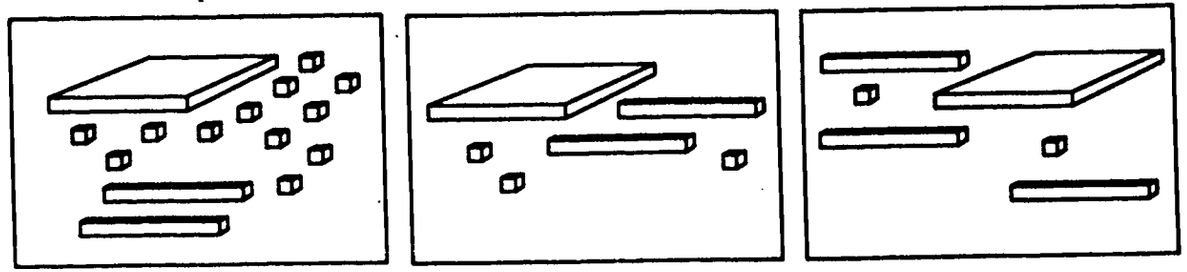
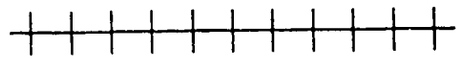
Grade 4
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- **use experimental or theoretical probability to represent and solve problems involving uncertainty.**

General Outcome	Specific Outcomes	Illustrative Examples
Design and use simple probability experiments to explain outcomes.	5. Identify an outcome as possible, impossible, certain, uncertain. [C, R]	5–6.1 For each of the following, draw a spinner that matches the statement. – It is impossible to land on 5. – You are more likely to land on red than on green. – It is equally likely that the spinner will stop on red, yellow, blue or white. – You are certain to spin an even number.
	6. Compare outcomes as equally likely, more likely, less likely. [C, R]	5–6.2 From a bag containing 3 red and 3 green cubes: – Is it possible to pull out a blue cube? – Is it possible to pull out a red cube? – Of what can you be certain? Pull out a cube, record the colour, and replace the cube in the bag. Repeat a number of times. What is likely to come out next? – If we change the cubes to 5 red and 1 green, will the outcome be different? – What if we increased the number of cubes? – How have the outcomes changed? – What other things might affect the outcomes?
	7. Design and conduct experiments to answer one's own questions. [C, E, PS]	6–7 Chinua and Scott put five tiles in a bag—4 yellow and 1 green. – Chinua makes up a game. He says he gets 1 point for every yellow tile, and Scott gets twice as many points for every green tile they pull from the bag. Will the game be fair? Why? – Conduct experiments to see if the game is fair. Stop each game when one colour has earned 10 points. Is the game fair? If not, how would you change it to make it fair? – Scott says the game would be better, if there were 10 green and 40 yellow tiles in the bag. Would this change the game? Explain your answer.

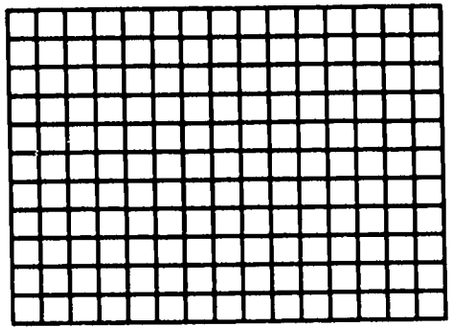
Grade 5
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals.	1. Demonstrate, concretely and pictorially, an understanding of place value from hundredths. [C, R, V]	1–3, 6 Tony drew these five number cards . . .  Use all of the five cards to show the following: – the greatest possible number – the least possible number – three other possible numbers. Write two of these numbers in words. Rewrite your numbers in order from least to greatest.
	2. Read and write numerals to 100 000. [C, CN]	
	3. Read and write number words to 100 000. [C, CN, V]	1–4, 6–7 Scan the newspaper for six different numbers. Be sure at least one number is close to one hundred thousand, and at least two numbers are less than one. Also try to find numbers used in different ways. Arrange your clippings in order, according to the size of the number involved. Rewrite numerals in words and vice versa. Show and explain how each number might be represented with blocks or fraction pieces.
	4. Use estimation strategies for quantities up to 100 000. [E]	1, 9 Let the flat represent 1 unit. Let the long represent 0.1 units. Let the centicube represent 0.01 units.  What decimal numbers can you show using any four of these pieces? How can you be sure you have all possible numbers? List the numbers from least to greatest.

Grade 5
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals.		1.1 Here are three pictures of student models.  Monica Wade Salmo Which model(s) show 1.32? Explain. Janice did not use a 10 by 10 flat in her model of 1.32. Draw a picture of what she could have used for her model. Build another model of 1.32, using base-10 blocks. 1.2 Your friend wants to know how many 2s you write down in order to write all the numbers from 1 to 100? How could you figure out the answer without writing all the numbers and counting them? 1.3 Locate 132.35 on the number line below and label the point *Z*.  132 133

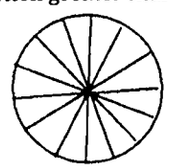
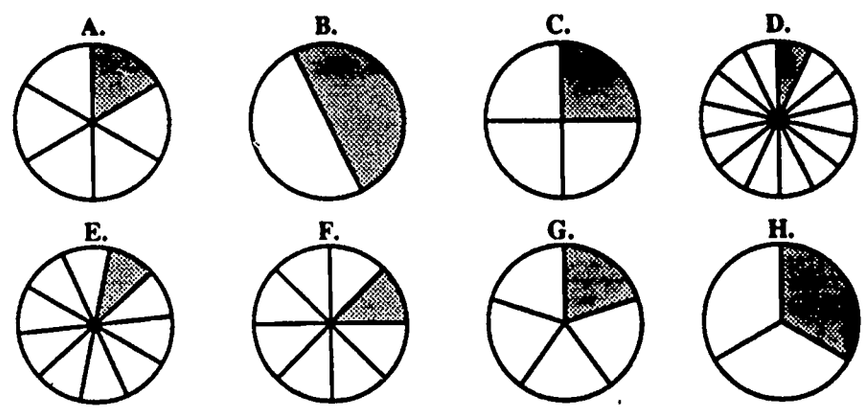
Grade 5
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals.	5. Recognize, model and describe multiples, factors, composites and primes. [C, R, V]	4.1 Tell how you would determine if one hundred thousand grains of rice would fill a 1 L container. Tell how you would determine the number of classrooms needed for 100 000 people to stand comfortably. 5.1 Marie is outlining rectangles to show that 24 is not a prime number. Show three of her rectangles on this grid.  Name three numbers less than 15 that are prime numbers. Choose one, and use rectangular drawings to explain why it is not a composite number. 5.2 Sort and record the numbers from 1 to 20, according to the rules listed in the following Carroll diagrams.
	6. Compare and/or order whole numbers. [C, R, V]	

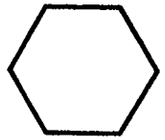
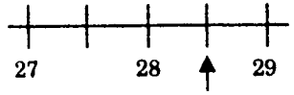
	Composite Number	Not a Composite Number
Even Numbers		
Odd Numbers		

	Prime Number	Not a Prime Number
Factor of 12		
Not a Factor of 12		

Grade 5
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals.	7. Represent and describe proper fractions concretely, pictorially and symbolically. [CN, R, V] 8. Demonstrate and describe equivalent proper fractions concretely, pictorially and symbolically. [C, R, V] 9. Compare and/or order proper fractions and decimals to hundredths. [C, R, V]	7–8. Name some fraction circles that can be used to show one half. What equivalent names match your choices? Give three other names equivalent to one half. Identify fraction circles that show two-thirds. Name a fraction greater than one half but less than two-thirds. How could you use fraction circles to show your reasoning.  7, 9 With the help of fractional strips or segmented circles, put the following fractions into order of increasing size: $\frac{5}{6}, \frac{2}{3}, \frac{3}{8}, \frac{2}{4}$. 7.1 Using the following set of fraction pieces, identify and name the fraction or fractions, which: – are closest to zero – closer to a half than to zero in size – the largest fraction in your set – closer to zero than to one half in size – close to, but not exactly, one half in size. 

de 5
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for whole numbers 0 to 100 000, and explore proper fractions and decimals.		8.1 Show that "one half is equivalent to three sixths", using the following figure.  Add, and trace, more pattern blocks to make a new figure that shows: – one fifth is equivalent to two tenths – six eighths is equivalent to three fourths. 9.1 Order the following: 25.5, 26.5, 2.5, 27.5 and 24. 9.2 Name each letter with the matching decimal fraction.  9.3 Put <, = or > in the boxes to show how the numbers or expressions are related. $\frac{1}{4}$ ☐ 0.2 0.61 ☐ 0.16 0.75 ☐ $\frac{8}{10}$

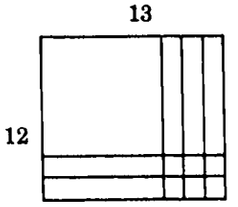
Grade 5
Strand: Number (Number Operations)
Students will:
- **demonstrate an understanding of and proficiency with calculations**
- **decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.**

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.	10. Add and subtract decimals to hundredths, concretely, pictorially and symbolically. [PS, V]	10.1 You have this amount of change: 2 dollar coins, 5 quarters, 13 dimes, 6 nickels and 14 pennies. These items are for sale: Pen $1.95 Note pad (large) 1.89 Note pad (small) 1.19 Pencil .59 Use this information to make up a problem. 10.2 You just got a gift of three goldfish from your grandmother and she gave you $20.00 to buy a bowl, a bowl ornament and a supply of fish food. The chart shows the prices of these items at three different stores.

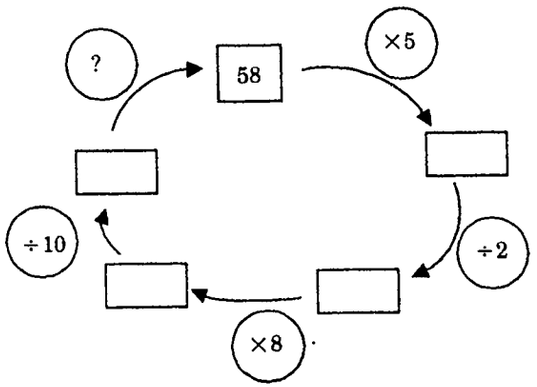
Item	Pet Zoo	Pampered Pets Shop	Johnson's Animals
Bowl	$7.00	$6.00	$8.00
Ornament	$8.50	$8.00	$4.75
Fish food	$5.50	$4.50	$5.25

- Choose a possible selection of bowl, ornament and food that you could buy with the $20.00.
- What is the cost of your selection?
- How much change would you receive?
- How many different ways could you buy the three things and still spend $20.00 or less? Show each combination.

Grade 5
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.	11. Estimate, mentally calculate, compute or verify, the product (3-digit by 2-digit) and quotient (3-digit divided by 1-digit) of whole numbers. [E, PS, T]	11.1 Greg and Nabat used base-10 blocks to build an array for 12×13.  Greg and Nabat did not record their thinking in the same way. **GREG** 12×13=(10×13)+(2×13) 12×13=130+26 12×13=156 **NABAT** 12×13=(12×10)+(12×3) 12×13=120+36 12×13=156 Explain the reasoning of each student. Build a model to explain 24×21. 11.2 Takashi says he thinks of money when he needs to mentally solve questions like these. 24×5 24×25 24×50 What are the answers, and how could Takashi have done each one?

Grade 5
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

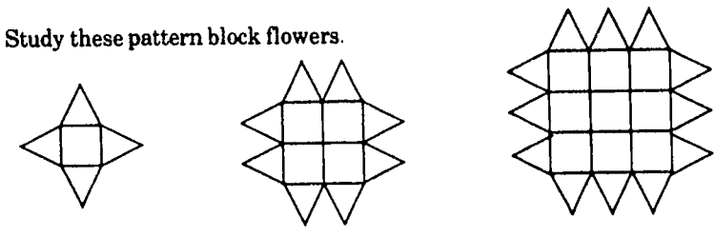
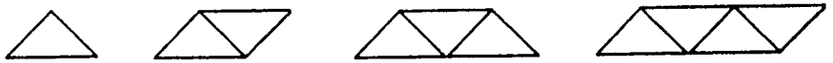
General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.		11.3 Fill in the boxes.  Fill in the final circle in two different ways. 11.4 Find two whole numbers (each greater than 10) whose product is 768. Explain how you obtained your answer.
	12. Multiply and divide decimals to hundredths, concretely, pictorially and symbolically, using single-digit, whole number multipliers and divisors. [PS, V]	12.1 Let a flat represent 1 unit. Let a long represent 0.1 units. Let a centicube represent 0.01 units. Use the blocks to explain the meaning and solution to this expression: 4×1.34 Use your solution to mentally calculate the following: 8×1.34 16×1.34 2×1.34

Grade 5
Strand: Number (Number Operations)
Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals, and illustrate their use in creating and solving problems.		12.2 A total of $295.79 was collected by 21 Grade 5 students for a field trip. What was the average amount collected by each student. Explain your answer, using play money.
	13. Solve problems involving multiple steps and multiple operations, and accept that other methods may be equally valid. [PS]	13.1 Using only the [2], [+], [−], [×] and [÷] keys on your calculator, make the display read 13.

Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

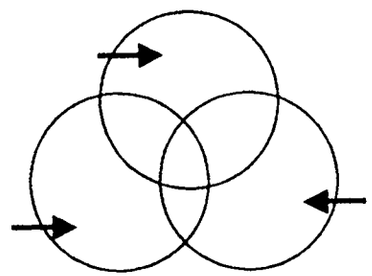
General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.	1. Develop charts to record and reveal patterns. [CN, PS]	1–5.1 Study these pattern block flowers.  1st 2nd 3rd – Make a chart to show this information, for the first six flowers: - the number of triangles for each - the number of squares for each. – Write a description of the 4th pattern block flower. – Explain the patterns you see in the numbers on your chart. – Predict the number of triangles and the number of squares you will need to build the 10th flower in the sequence. – If Sharon has 150 triangles and 125 squares, what is the largest flower she can build, using these rules? Explain your thinking. 1–5.2 Use stir sticks to copy these triangular shapes. Build the next three shapes. How many stir sticks are needed to build five triangles?  Copy this chart. Complete the chart to record the number of Δs and the matching number of stir sticks in your constructions. Predict the number of stir sticks needed to make 75 triangles. Explain how you arrived at your solution.

Number of triangles	1	2	3							10		75
Number of sticks	3											

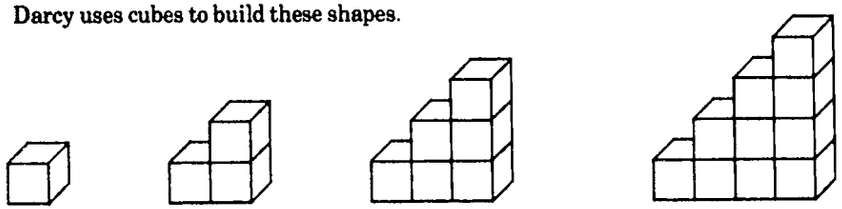
Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.		1, 3 Use base-10 unit cubes to make squares. For each square, find its perimeter and its area. Make a chart to find the pattern. 1, 4 Chairs have four legs each and stools have three legs each. Make a chart of your own design to determine how many chairs and stools are necessary to come up with 31 legs. Find all possible combinations. 1.1 How many numbers less than 1000 have 12 as the sum of their digits. Examples: 84 $8+4=12$ 129 $1+2+9=12$ 507 $5+0+7=12$ Carefully organize your investigation. Describe the patterns you see in the numbers. 1.2 It takes six police officers on motorcycles to escort one sports team in a parade. The organizers must find four more police officers for each team that joins the parade. Construct and label a chart that can be used to see the number of police officers needed to escort from 1 to 10 sports teams. 1.3 Mark, Samual, Anna and Céline each prefer a different flavour of ice cream. chocolate mint strawberry vanilla No one prefers a flavour with the same number of letters as his or her name. The one who prefers mint likes sugar cones. The one who loves vanilla always puts chocolate syrup on top of his treat. Anna is allergic to chocolate. Match each person with his or her favourite ice cream.

Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.	2. Describe how a pattern grows, using everyday language in spoken and written form. [C, CN]	1.4 In one community club, eight members signed up for cheerleading, 14 for drama and 10 for dance. Of these totals, 2 chose only cheerleading, 3 chose dance and drama and 1 chose all three activities. How many chose only drama? How many chose only dance? How many chose cheerleading and drama? Explain your reasoning for each solution.  2–3 Hanif is building "T" numbers. This is how he describes his models. "I used five tiles to build the first 'T' number. Each larger 'T' uses three more tiles than the 'T' number before it." Use Hanif's description to build the first four "T" numbers. Record your models. Construct the first four models of your own 2- or 3-dimensional pattern. Write a description that explains how your pattern grows.

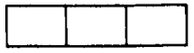
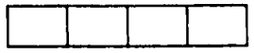
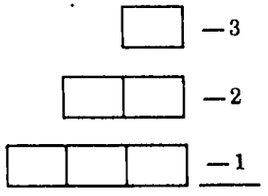
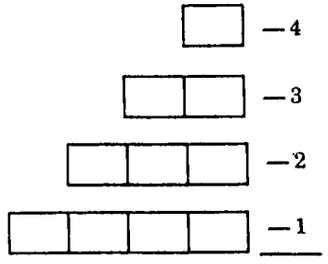
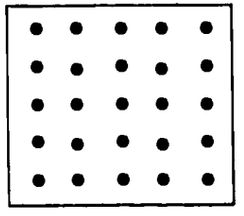
Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.	3. Construct and expand patterns in two and three dimensions, concretely and pictorially. [PS, V]	2.1 Darcy uses cubes to build these shapes.  1. 2. 3. 4. Explain how the pattern grows. 3–5 Luis developed this chart to match a set of toothpick models. | | 1st | 2nd | 3rd | 4th | 5th | 6th | | --- | --- | --- | --- | --- | --- | --- | | Number of toothpicks | 6 | 11 | 16 | | | | – Predict the next three numbers in the sequence. Explain your reasoning. – Predict the number of toothpicks needed to build the 25th shape. Justify your answer. – Use the toothpicks to build the first three models in the sequence.

Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.	4. Generate and extend number patterns from a problem- solving context. [PS, R]	4–5.1 Use a calculator, if needed. Find answers to each set of problems. Set 1 12 ÷ 2 = _____ 24 ÷ 4 = _____ 48 ÷ 8 = _____ 96 ÷ 16 = _____ Set 2 288 ÷ 24 = _____ 144 ÷ 12 = _____ 72 ÷ 6 = _____ 36 ÷ 3 = _____ Set 3 28 ÷ 4 = _____ 280 ÷ 40 = _____ 2800 ÷ 400 = _____ 28 000 ÷ 4000 = _____ – Explain the pattern in each set. – For Set 2, what is a problem: - that fits before 288 ÷ 24? - that fits after 36 ÷ 3?
	5. Predict and justify pattern extensions. [C, R]	

Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.		4–5.2 Derek wrote the following in his journal: "I use patterns to help solve geometry problems like these: How many rectangles are there in this figure?"  Problem 1  Problem 2  —3 —2 —1 Total = 6 Rectangles  —4 —3 —2 —1 Total = 10 Rectangles Do you agree with Derek's solutions? Why? How would you solve these problems? How many rectangles are there in this figure? How many squares are there in this figure?  Write your own journal entry to explain how you solved these problems.

Grade 5
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

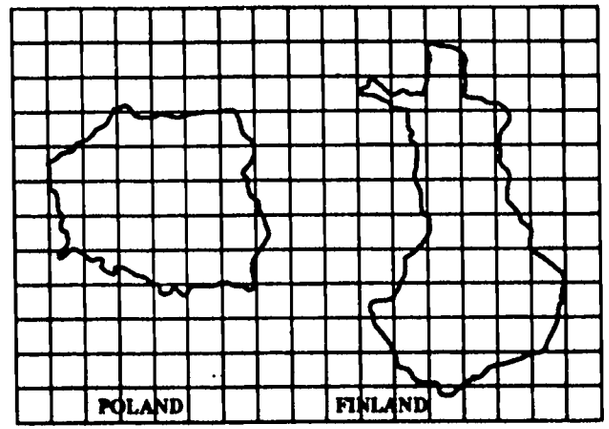
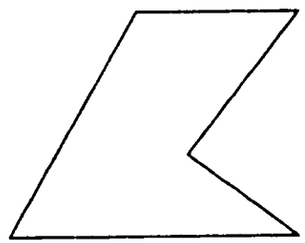
General Outcome	Specific Outcomes	Illustrative Examples
Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators.		4.1 The community centre was charging $1.00 to see a movie. $25.00 was collected on the first day. $17.00 more was collected on the second day than on the first day. After two days the club had collected $67.00 in all. On the third day, $17.00 more than the second day was collected. If the pattern continues, on what day will the club have collected at least $500.00?

	Day 1	Day 2		
Day's collection ($)	25			
Total collected ($)	25	67		

Grade 5
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.	1. Recognize and explain the meaning of length, width, height, depth, thickness, perimeter and circumference. [C]	1.1 Draw a 3-dimensional outline of each shape: – soup can – cereal box – story book. Find an object with a: – circumference of approximately 21 cm – depth of approximately 10 cm – perimeter of approximately 20 cm – width of approximately 22 cm – thickness of approximately 1 mm – height of approximately 2 m – an area of approximately 600 cm^2.
	2. Evaluate the appropriateness of units and measuring tools in practical contexts. [CN]	2.1 Identify the measuring tool and unit best used to measure: – the volume of air in your classroom – the capacity of a pill bottle – the mass of a train car full of wheat – the surface area of a kitchen table.

Grade 5
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.	3. Estimate and measure the perimeter of irregular shapes. [E, R]	3–4  These are the outlines of two countries. – Estimate the area of each in squares. Explain your strategy. – Which country has the greatest area? – Which country likely has the longer perimeter? – Outline a shape with more area but about the same perimeter as Finland. – Estimate the area of one square in km^2. Explain your reasoning. 3.1 Determine the perimeter of the figure below. 

Grade 5
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.	4. Estimate and measure the area of irregular shapes by dividing them into parts. [E, R]	
	5. Estimate and measure the effect of changing one or more dimensions of a rectangle on its: • perimeter • area. [E, R]	5–6 Monique used square tiles to construct a rectangle with a perimeter of 20 km and an area of 21 cm^2. What are the dimensions of the rectangle? Use only whole numbers of centimetres for your answers. She decides to keep the perimeter at 20 cm. Predict what will happen to the area of her rectangle, if she – increases the length of her rectangle – decreases the length of her rectangle. Outline and cut all possible rectangles with a perimeter of 20 cm. Check your predictions.
	6. Relate perimeter and area of rectangles, using manipulatives and diagrams. [CN, R]	6.1 Do you think a square and a rectangle with the same perimeter have the same area? Explain your reasoning. Draw pictures to help others visualize your thinking.
	7. Estimate, measure, record and order containers by volume, using cm^3. [E, PS]	7–8.1 Mandi builds a cube with each side 3 cm long, using centicubes. How many cubes does she use? She fills a graduated cylinder with water to the 500 mL mark. Mandi predicts the water will rise to about the 600 mL mark, if she pushes her cube just below the surface of the water. Do you agree with Mandi's prediction? Why, or why not? Build the cube and conduct the experiment. Do the results verify your thinking? Explain. 7–8.2 How many mL of juice will fit inside a plastic container whose volume has been calculated as 705 cm^3? Explain. 7.1 Choose three different cracker boxes. Estimate the volume of each box in cubic centimetres. Order the boxes according to your estimate. Show how to use centicubes or a ruler to check your estimates. Were your predictions right? Explain your results.

Grade 5
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

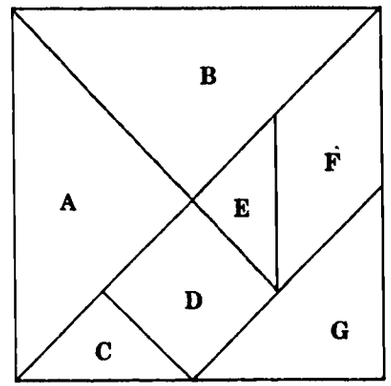
General Outcome	Specific Outcomes	Illustrative Examples
Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.	8. Use concrete materials to relate cm^3 to mL. [CN,V]	
	9. Construct objects of a specific volume, expressed in cm^3. [PS]	9.1 Use centicubes or interlocking cubes to build cubes with lengths of 2 and 3 units. Draw 3-D pictures of the first three cubes. Fill in the chart to show the number of cubes needed to build the first four cubes. Then explain how to use a calculator to fill in the remaining numbers on the chart.
		9.2 Construct an object of 24 cm^3.
	10. Solve problems involving mass (weight), using g, kg and t. [PS]	10.1 Supermarkets order groceries in large lots. About how many packages are there in: – 1 t of cookies, packed in 400 g packages – 1 kg of spices, packed in 5 g packages? Explain your reasoning.
	11. Read an analog clock to the nearest minute, and write the time. [C]	
	12. Read and write time on a 24-hour clock. [C]	12.1 An air flight arrives at 21:05 and departs at 22:18. Use numbers and symbols to write each time another way. A sign used the 24-hour clock to show No Parking from 3:30 p.m. to 6:00 p.m. What times must have been written on the No Parking sign?

CUBES	Length of edge (cm)	1	2	3	4			
	Number of centicubes used							

Grade 5
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Use measurement concepts, appropriate tools and results of measurements to solve problems in everyday contexts.	13. Read and write SI notation for recording date and time. [C]	13.1 Use SI notation to write the following: – today's date – your birthday – when you will graduate from high school – a date that is special to you.

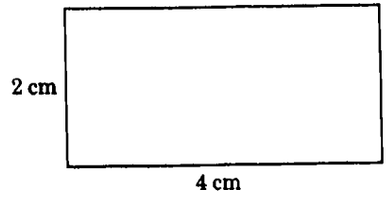
Grade 5
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use visualization of 3-D objects and 2-D shapes to solve problems related to spatial relations.	14. Construct, analyze and classify triangles according to the side measures. [E, R, V] 15. Build, represent and describe geometric objects and shapes. [C, PS] 16. Identify and name polygons according to the number of sides, angles and vertices (3, 4, 5, 6 or 8). [C, R, V] 17. Cover a given 2-D shape with tangram pieces. [PS, V]	14.1 Kylee had a supply of straws in three different lengths: 9 cm, 15 cm and 20 cm. How many different triangles could she make? Use straws or pictures to explain your answer. Sort the triangles into sets with no equal sides, 2 equal sides and 3 equal sides, and name each set. 15, 17 Look at the tangram puzzle shown. Can you make a triangle with 2 tangram pieces? 3 pieces? 4 pieces? 5 pieces? 6 pieces? All 7 pieces? Draw and label pictures to show the triangles and the pieces used.  15.1 Make a large class chart like the one below to show the shapes you can build with tangram pieces. Fill all the spaces. Pieces are traced, cut out and posted as solutions are found. Three examples are given. Try to make each shape, using different numbers of tangram pieces. You may not find them all.

	Square	Rectangle	Triangle	Parallelogram	Trapezoid
1 piece	□				
2 pieces	◿				
3 pieces	◸				
7 pieces					

Add in rows for 4, 5 and 6 pieces

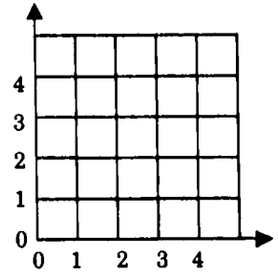
Grade 5
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use visualization of 3-D objects and 2-D shapes to solve problems related to spatial relations.		15.2 Draw a polygon with at least one acute angle, one right angle and one obtuse angle. What is the smallest number of sides this polygons can have?
	18. Complete the drawing of a 3-D object, on grid paper, given the front face. [E, V]	18.1 Given the front face of a 2 cm × 4 cm × 3 cm box, draw the 3-D shape. 
	19. Determine, experimentally, the minimum information needed to draw a given 2-D shape. [R, V]	19.1 What other information do you need to know so that you and a friend can draw the same triangle, if all you know is that one side must be 2 cm and another is 3 cm?

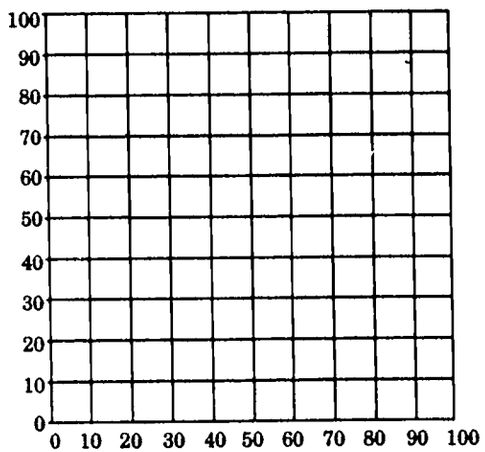
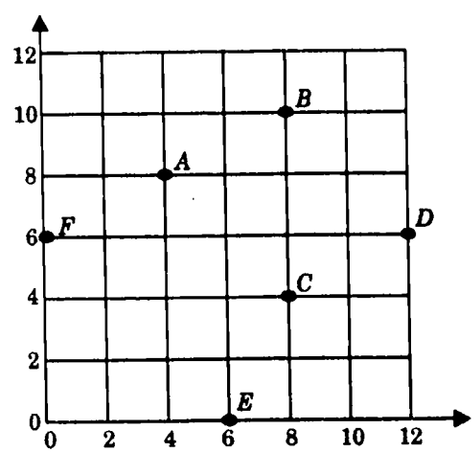
Grade 5
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Describe motion in terms of a slide, a turn or a flip.	20. Recognize motion as a slide (translation), turn (rotation) or a flip (reflection). [T, V]	20.1 What kind of motion moves your cursor from cell to cell on a computer spreadsheet. What is one path your cursor might take to move from cell A1 to cell D5? 20.2 Cut out the shape. Use it as a tracer to create three different wallpaper designs. Use only slides to create one paper, only flips to create a second paper, and turns as well as slides to create the third paper. Which do you prefer? Explain.
	21. Recognize tessellations created with regular and irregular shapes in the environment. [CN, V]	21.1 In your neighbourhood what are some examples of tessellations created from tiling with regular shapes? Draw one. What is an irregular shape? Give one instance of such a shape being used in a tessellation. Tell whether you prefer tessellations produced by using regular or irregular shapes. Why?
	22. Cover a surface, using one or more tessellating shapes. [PS, T, V]	22.1 Demonstrate, with pattern blocks, whether or not it is possible to tessellate a surface, using only: – the blue rhombus and slides – the trapezoid and flips – the tan rhombus and turns. If an example is not possible, investigate and report how the block can be used to tessellate a surface. 22.2 Use pattern blocks to create a tessellation that is at least 25 cm by 25 cm in area.

Grade 5
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Describe motion in terms of a slide, a turn or a flip.	23. Create tessellations, using regular polygons. [PS, T]	23.1 Use tape to fasten two different regular pattern block pieces together. Will the new shape tessellate a surface? If so, did you use slides, turns or flips? Try different pairs of blocks, then create and colour a tessellation with your favourite block combination. 23.2 Use a combination of regular pattern blocks to create a triangle similar to the green triangle. Design the block to have one line of symmetry. Create and colour a tessellation.
	24. Identify planes of symmetry by cutting solids. [PS, V]	24.1 Construct 3-D solids out of molding clay. Use a piano wire to cut each solid along a plane that you think divides your solid into two congruent halves. Report your investigation in your mathematics journal. Tell how many planes of symmetry you found in each solid. Draw and label the shape of the symmetrical plane(s) found. Tell where you have seen similar planes in the human-made structures in your community.
Use coordinates to describe the positions of objects in two dimensions.	25. Plot whole number ordered pairs in the first quadrant with intervals of 1, 2, 5, 10. [C]	25–26 [also relates to SO 14] On this grid, mark and label the two points A (1, 2) and B (3, 2). Join these with a straight line.  On the grid mark another point C so that the triangle ABC is an isosceles triangle. Write down the coordinates of point C. Mark point D so that ΔABD is a right triangle. Write the coordinates of D. Mark point E so that ΔABE is a scalene triangle. Write the coordinates of E.

Grade 5
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

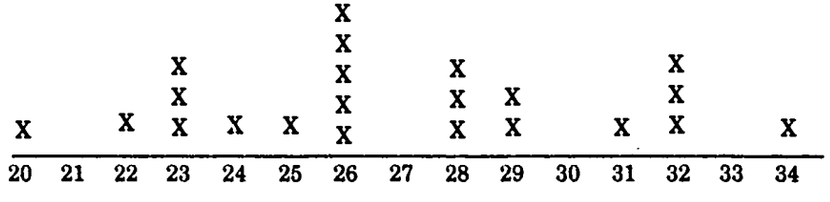
General Outcome	Specific Outcomes	Illustrative Examples
Use coordinates to describe the positions of objects in two dimensions.	26. Identify a point in the first quadrant, using ordered pairs. [C]	25.1 – Plot the points on the grid. – *A* (10, 30) *B* (60, 20) C (80, 90) – Join the points to outline a shape – What different ways do you know to describe the shape?  26.1 – Match the given ordered pairs with the letters on the graph. – (6, 0) (4, 8) (8, 4) (8, 10) (0, 6) (12, 6) – Slide point *E* up 1 and left 1. Name its new location. – What kind of quadrilateral is formed by joining the points? – What is the area of this quadrilateral? 

Grade 5
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and interpretation of data to answer a question.	1. Identify a question to generate appropriate data, and predict results. [C, R]	1, 2 There are many different ways that potatoes can be prepared for eating. How would you word the question, if you want to learn more about peoples' preferred ways of eating potatoes? What results do you predict? Describe a population and a sample that you could use to answer your question.
	2. Distinguish between a total population and a sample of that population. [R]	2.1 For what question could our class be considered as: – the total population? – a sample of a population?
	3. Use a variety of methods to collect and record data. [PS, T]	3–4 A Grade 5 class learned that thousands of very large and very small potatoes are left in market gardeners' fields each fall. They decide to investigate only those potatoes that do get picked and packaged for sale in grocery stores. What questions might they use to best guide their investigation. Predict what might be the answer to each question designed. Write out a plan for the investigation. Include information on each of the following: – selecting a sample – collecting the data – recording the data – displaying the data. Choose one question, or part of a question, designed above, and follow your plan. Write about the results of your investigation. What things have you learned about potatoes that get packaged for market?

Grade 5
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

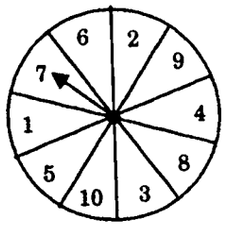
General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and interpretation of data to answer a question.	4. Evaluate the graphic presentation of the data to ensure clear representation of the results. [C, R]	3.1 Take some potatoes from a 10 kg bag picked randomly from a grocery store. Use a variety of ways to record your data for the following questions: – by observation and counting How many eyes does each potato possess? – by measurement tools How long is each potato? What is the circumference of the potato measured at the middle? What is the mass of each potato? – by survey What is your favourite way to eat potatoes? (mashed, fried, scalloped, baked) Use research to find out what brands of potatoes are most commonly sold in local grocery stores. 4–5 A class timed how long it took each person to count to 100.



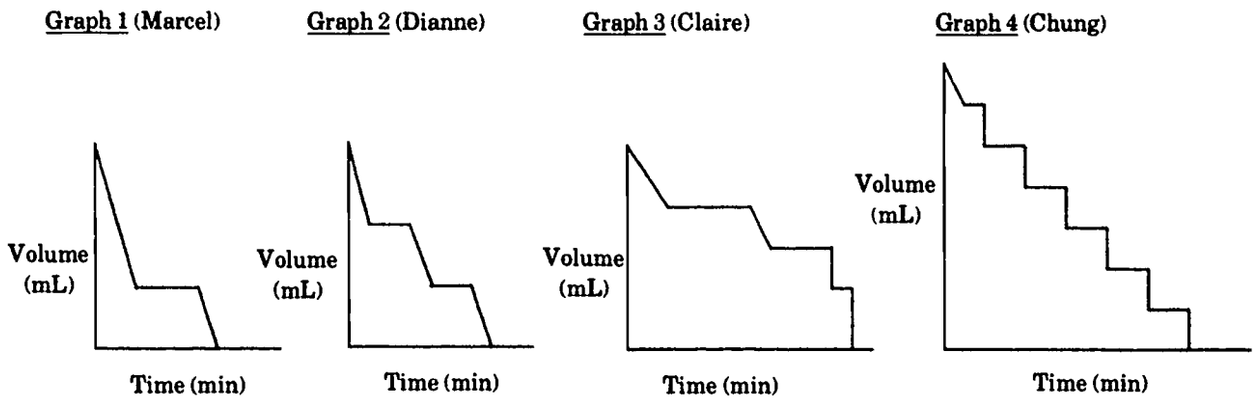
Time Interval (s)	Individual Result (s)	Number of Students
20–24	20, 22, 23, 23, 23, 24	6
25–29	25, 26, 26, 26, 26, 26, 28, 28, 28, 29, 29	11
30–34	31, 32, 32, 32, 34	5

What is the same about each representation of the data? What is different?
Do you think one display better reveals the data than does the other? Why?
Choose another way to present the data. Label your work so others can read your graph quickly and accurately.

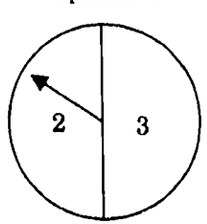
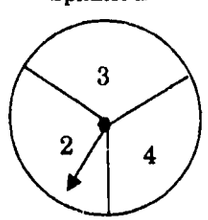
Grade 5
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and interpretation of data to answer a question.	5. Create classifications and ranges for grouping data. [PS, R]	5. Determine groupings to show height changes throughout the school year; e.g., September to January/June. Determine the age groupings for the most listened to music. Why did you choose to use the number of intervals you did? E.g., three groups as opposed to four groups.
	6. Display data by hand or by computer in a variety of ways, including: • frequency diagrams • line plots • broken-line graphs. [C, T, V]	6–8 Wui-Ching needs to spin a 6, or any of its factors, to win a game. Spin a Factor of 6  On a tally chart, record the data from at least 50 spins. Show all your data on a frequency diagram. Do you think Wui-Ching is more likely to win or lose the game? Why?
	7. Discuss the reasonableness of data and results. [C, R]	7.1 Tina, Rex and Liz are conducting reaction time experiments with a metre stick. Each person gets three chances to see how quickly they catch the metre stick after it is dropped. Here are their results. Distance Dropped (cm) Trial Number | Tina | Rex | Liz 1 | 50 | 17 | 20 2 | 40 | 26 | 22 3 | 15 | 23 | 59 Explain who has the best reaction time, if: – the lowest number of centimetres on any particular trial wins – the high and low distance for each person is eliminated – the average distance for each person is calculated by adding their three numbers and dividing by 3. What method do you think is most fair for determining the best reaction time? Explain your reasoning. What number represents the mean reaction distance of all three friends? Make a bar graph to visually explain and verify your calculation.

Grade 5
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and interpretation of data to answer a question.	8. Make inferences to generate a conclusion about the data. [E, PS]	8.1 Four friends each bought a large cold drink on a hot summer day. Explain what each graph tells you about how each person drank.  Draw a graph to represent how you might drink a cold drink on a hot summer day.

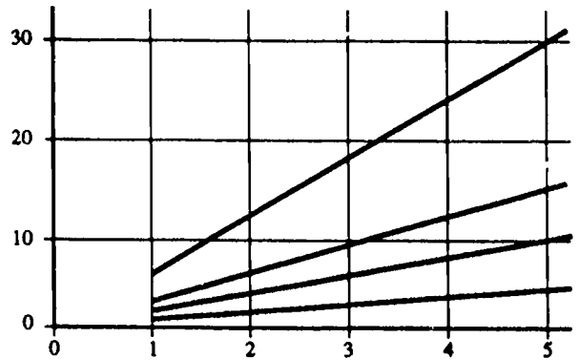
Grade 5
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Predict outcomes, conduct experiments and communicate the probability of single events.	9. List all possible outcomes of an experiment involving a single event. [PS]	9–12 Yvon tossed 20 tacks. 13 tacks landed on their points. He uses the fraction $\frac{13}{20}$ to describe the probability of tossing "points". Top Point Yvon says he can now predict 39 "points", if he tosses 60 tacks. Explain his reasoning. Conduct an experiment to test Yvon's prediction. Compare your results with his prediction. Start a new experiment. Toss the tacks to establish the probability of landing "tops". Use your fraction to predict tossing "tops", and conduct an experiment to check your prediction. Compare your results with your expectations. If you continue to conduct experiments with tacks, will you improve your ability to toss exactly the number you predict? Why?
	10. Describe events, using the vocabulary of probability: • best/worst • probable/improbable • always/more likely/ equally likely/less likely/never. [C, R]	9–10 Use one or both spinners shown to make up a true statement, using the following: – never – less likely – more likely – always Spinner A  Spinner B 
	11. Conduct probability experiments, and explain the results, using the vocabulary of probability. [C, E, PS]	
	12. Conduct probability experiments to demonstrate that results are not influenced by such factors as the age, experiences or skills of the participant. [R, T]	

Grade 6
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.	1. Read and write numerals greater than a million. [C, CN]	1, 12 Read the paragraph below. Rewrite number words, using numerals, and rewrite numerals, using number words: In her book called *What Do You Prefer: Chunky or Smooth?*, Heather Brazier tells us the following: "On an average day in Canada . . . We consume eighty thousand, eight hundred forty-nine kilograms of peanut butter. Of the total, 20 212 kg are chunky." (p. 46) According to the information provided, how many kilograms of smooth peanut butter must be eaten by Canadians on the average day? Ms Brazier writes that Canadians choose smooth over chunky 3 to 1. Explain what she means. Write, in words, the number of kilograms of peanut butter Canadians will consume in one hundred days. 1.1 The day after a telethon, the radio reported that about $2.1 million was raised. Explain why the value would be expressed in this way. What may have been the amount raised?
	2. Estimate quantities up to a million. [E]	2.1 On a field trip, have students estimate the number of seats in a hockey rink, theatre or stadium. Compare your result to the box office count. 2.2 What could you buy for a million dollars? Describe your answer in terms of cars, houses or groceries. 2.3 About how many pages in your local telephone book do you think are needed to list ten thousand names? Explain your estimation strategy. How can you check you prediction, without counting ten thousand names? Carry out your plan, and compare your prediction with your results. Use your work to predict the number of pages needed to list: - one hundred thousand names - one million names. Did you use estimation, mental mathematics or a calculator to find these solutions? Why?

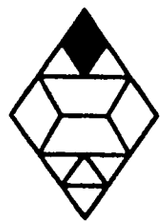
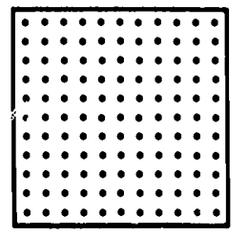
Grade 6
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.	3. Distinguish among, and find, multiples, factors, composites and primes, using numbers 1 to 100. [R]	3–4 Study this representation of the multiplication facts.  What multiples of 6 are plotted? What factors of 12 are plotted? If the graph was extended in length and width to 100, what composite number would have the greatest number of factors plot d. What would the points be? If the lines for each multiple we e extended backward, what point would all lines travel through? Why? 3.1 Draw a Venn diagram. Sort the numbers from 1 to 25, by these rules: – prime – greater than 10.

Grade 6
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.	4. Recognize, model, identify, find and describe common multiples, common factors, least common multiple, greatest common factor and prime factorization, using numbers 1 to 100. [C, PS, R, V]	4.1 Josie and Pierre work part time at the local store. Josie works every four days and Pierre works every six days. If they both start today and the store is open every day of the week, when will they work together again?
	5. Explain the meaning of integers by extending counting numbers to less than zero. [R]	5.1 A certain negative integer is: – less than -3 – greater than -8 – farther from -8 than -3. What is the integer? Draw and label a number line to justify your answer. Make up another set of clues about a negative integer.
	6. Identify practical applications of integers. [CN, PS]	6.1 Explain how negative numbers are used to help describe the following: – golf scores – temperature – an example of your choice.
	7. Read and write numbers to thousandths. [C, CN, V]	7, 9 Trevor's homework revealed this statement: $0.790 \boxed{>} 0.79$ Is he correct? What model(s) or diagram(s) would you use to justify your answer? Order these numbers from least to greatest: 0.499 2.66 $\frac{4}{3}$ $1\frac{7}{8}$ 0.1 Construct a number line to help Trevor visualize your thinking. Label each number.

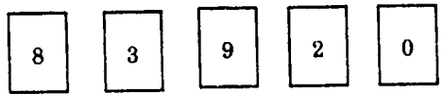
Grade 6
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.		7.1 It takes the Earth 365.256 days to revolve around the Sun. Read the number aloud, and write the number in words.
	8. Round numbers to the nearest unit, tenth and hundredth.	8.1 What number could be in the thousandths place, if a number rounds to 6.53?
	9. Demonstrate and explain the meaning of improper fractions and mixed numbers (positive) concretely, pictorially and symbolically. [C, R, V]	9.1 With the help of pattern blocks, and using the value of the yellow hexagon as one whole, make a pattern with a value of $2\frac{1}{3}$. 9.2. The following diagram is made from pattern block pieces. If the shaded area has a value of $\frac{1}{3}$, what is the value of the whole design? Make a design with a value of eleven thirds. Rearrange the blocks to show eleven thirds as a mixed number. 
	10. Demonstrate and explain the meaning of ratio concretely, pictorially and symbolically. [C, CN, R, V] 11. Demonstrate and explain the meaning of percentage concretely, pictorially and symbolically. [C, CN, R, V]	10–11.1 Let the largest possible square on an 11 by 11 pin geoboard have a value of 1. Construct a different (noncongruent) shape for each part named below: – 0.25 of the square – $\frac{1}{4}$ of the square – 25% of the square.  Record, colour and label each shape on geodot paper. How is each coloured part the same? Shannon outlined a new shape. She says the ratio of the coloured part to the whole square is 3:5. Record and colour one possible shape. Record other ways to name the shape as part of 1.

Grade 6
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.		10–11.2 Dennis linked 10 cubes together in this order: G G G G Y G G G G Y What colours are described by these ratios: 2:8 4:1 8:10 Suppose Dennis continued the pattern to cover a 10 by 10 grid. How would the ratios change? How would you use per cent to describe: – the green area? – the area not green? – the red area? Would it be true to write the following about the yellow area? $0.20 = \frac{2}{10} = \frac{1}{5}$ Explain. Draw and colour a 5-cube train. Describe the colours in different mathematical ways. 10.1 A punch is made by mixing 3 L of pop with 1 L of orange juice. Model the situation with two different coloured tiles. Find the amount of pop required for 2 L of orange juice, 3 L, 4 L. Write each case as a ratio.

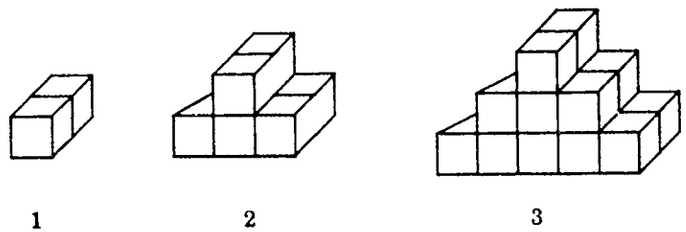
Grade 6
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals in solving problems.	12. Solve problems that involve arithmetic operations on decimals to thousandths, using appropriate technology (2-digit whole number multipliers and dividers). [PS, R, T]	12–13.1 Bohdan needs to cut 7.92 m of trophy ribbon into six equal lengths. Why should he estimate before he actually calculates the solution? What might he estimate each length to be? Explain your method. If Bohdan has no calculator or pencil, how might he find the actual solution? Explain your method. 12–13.2 Which of these expressions has the same product as 12.8×48? – 8×4.8 – 64×9.6 – $2 \times 6.4 \times 4 \times 12$ – 25.6×24 – 128×4.8 Write several expressions that would have the same product as 60×24.4. 12.1 Nigel and Maria are combining their money to buy a gift. Together they have \$52.08. Maria has \$12.08 more than Nigel. How much did each have before they combined their money? Make up a new problem like this one.
	13. Estimate the solution to calculations involving whole numbers and decimals (2-digit whole number multipliers and divisors). [E, PS, R]	13.1 Use all the cards. Create a decimal number and a 1-digit number. Arrange the numbers to get the greatest quotient. Do you have a strategy that will work successfully on any set of digits? Explain, using a calculator to check several examples.  13.2 On an average day in Canada, about seventy-two thousand six hundred eighty-five Canadians celebrate their birthdays. About how many people must there be in Canada? Estimate your answer. Check your estimate with a calculator.

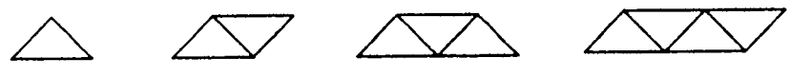
Grade 6
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on whole numbers and decimals in solving problems.		13.3 When would you use mental mathematics, paper and pencil calculation, or a calculator to answer each of the following questions? – What fraction of a day is an hour, a minute, a second? – How many items in a gross (twelve dozen), a dozen gross, a hundred gross? Justify each decision. Answer each question. 13.4 In the book, *Counting on Frank* by Rod Clement, Frank's master learns that the average ballpoint pen can produce a line twenty-one hundred metres long. The ratio of a line draw by a ballpoint pen compared to a pencil is about 1:18. About how many kilometres long would the pencil line be? Frank's master imagines drawing lines on the walls. What process would you use to find about how many times you can draw a line around the perimeter of your classroom using: – a ballpoint pen – a pencil. Explain. 13.5 How would you use a calculator to find an estimate for this question? About 280 million cans of one brand of pop are sold each day. About how many days does it take to sell enough cans to make a stack that would reach the Moon—385 000 kilometres away? Keep a record of your work, and plan to report your results to the class.
	14. Use a variety of methods to solve problems with multiple solutions. [PS, R, T, V]	14.1 A friend says she is thinking of a number. When 100 is divided by the number, the answer is between 2 and 5. Give at least three possibilities of what this number could be Explain your reasoning. (You may use examples.)

Grade 6
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

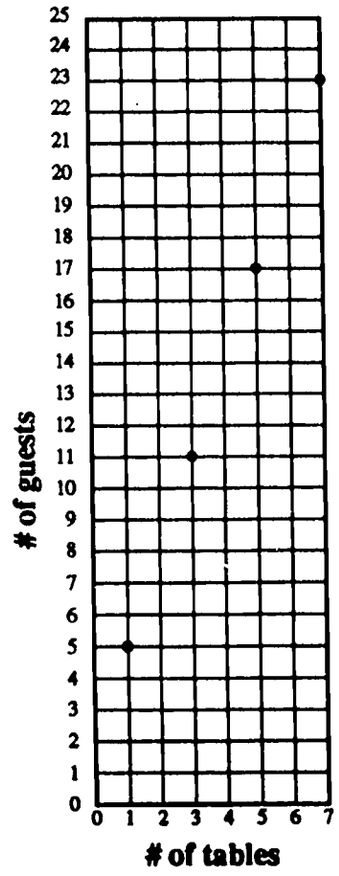
General Outcome	Specific Outcomes	Illustrative Examples
Use relationships to summarize, generalize and extend patterns, including those found in music and art.	1. Represent, visually, a pattern to clarify relationships and to verify predictions. [C, R, V] 2. Summarize a relationship, using everyday language in spoken or written form. [C, R] 3. Create expressions and rules to describe, complete and extend patterns and relationships. [C, CN, PS, R]	1–4 Series 1  1 2 3 Provide a written description of how to build the fourth model in the series. Include a drawing. Then describe any patterns that can be seen in the models. Chart the number of cubes needed to build the first five models. Graph the relationship between the number of the model and the number of cubes needed to construct each. Use your graph to predict the number of cubes needed to build the 6th model. 1–2.1 Greg used counters to build rectangles that expand in two directions. Then he produced this chart. Term | 1 | 2 | 3 | 4 | Number of Counters | 2 | 6 | 12 | 20 | Draw or use counters to construct the first four rectangles in Greg's pattern. Record your work on paper. How are the numbers in each column on the chart related. Explain. Will 60 be a number that appears, if the chart is extended? Explain why or why not.

Grade 6
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

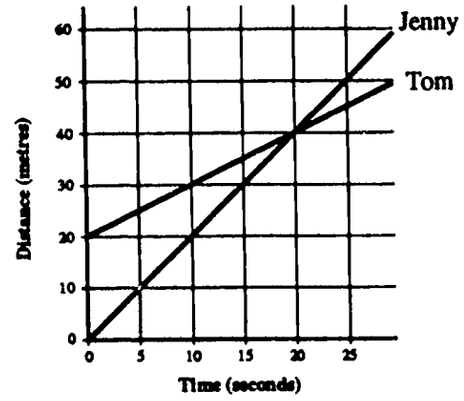
General Outcome	Specific Outcomes	Illustrative Examples
Use relationships to summarize, generalize and extend patterns, including those found in music and art.		1–2.2  Gretta sees that the number of lines increases by two for each triangle that is added. She predicts that the number of lines used is two times the number of triangles used. Do you agree with Gretta? Why? Use a grid to plot the number pairs in the pattern, and use your graph to justify your answer.

No. of Triangles	No. of Lines
1	3
2	5
3	7
4	9

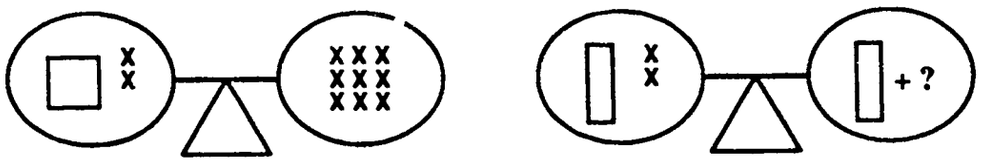
Grade 6
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Use relationships to summarize, generalize and extend patterns, including those found in music and art.	4. Find approximate number values from a given graph. [PS, R]	4.1 Joanne's graph plots the number of guests that can be seated at 1, 3, 5 and 7 tables. Explain how to use her graph to determine the number of people that can be seated, if the number of tables is even, but less than 8. How might you determine the number of guests who can be seated at 10 tables. 

Grade 6
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Use relationships to summarize, generalize and extend patterns, including those found in music and art.		4.2 Tom and Jenny had a 60 m race.  Read the graph to find the answers to these questions: Who wins the race? By how much? Where did Jenny let her little brother begin the race? Who was leading after 15 seconds? By how much? How many seconds from the start did Jenny overtake Tom? How far from the start of the race did Jenny overtake Tom? If they run the race again, where should Tom start, if he is to reach the 60 metre line at the same time as Jenny? Explain your reasoning.

Grade 6
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

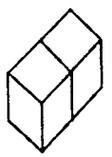
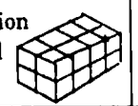
General Outcome	Specific Outcomes	Illustrative Examples
Use informal and concrete representations of equality and operations on equality to solve problems.	5. Demonstrate and explain the meaning and preservation of equality by balancing objects, or by using models and diagrams. [C, CN, PS, R, V] 6. Use pre-algebra strategies to solve equations with one unknown and with whole number coefficients and solutions. [PS, R]	5.1 How does the shape of a rectangle affect the perimeter, if the area remains constant? Generalize the effect on the perimeter when the sides are changed. 5.2 Lydia has 144 squares of fudge arranged in a single layer. Suggest how she might design a box to hold the fudge and to have the smallest possible perimeter of its base. 6.1 Use the balance scale at the mathematics centre to demonstrate how to find the masses of the various problem shapes. Possible scale set-ups:  6.2 Fill in the missing number(s) in each equation. Choose two and explain how you know your answer is correct. $7+\square=9+4$ $16-7=3+\Delta$ $\Delta\times6=60\div2$ $2\times(3+5)=\square-4$ $\Delta+(3\times6)=\Delta+\Delta+15$ 6.3 Find the value of the variable in each equation. Choose one question you found easy, and one you found not easy to answer. Explain the strategy you used to solve each. a. $16=n+3$ b. $t+t+7=15$ c. $d+4=(3\times2)+4$ d. $33-12=37-h$ e. $12\div z=24\div4$

Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.	1. Use conversions among commonly used SI units of length, mass (weight) and capacity (volume) to solve problems. [E, PS]	1.1 Match the Canadian coin or bill with the correct width. penny 2.5 cm two dollar bill 19 mm nickel 0.07 m dollar coin (loon. 2.2 cm quarter 0.02 m dime 28 mm Use a ruler and real money to check your decisions. 1.2 What is the difference between the highest and lowest price. Explain how you know. Alaskan pollock fillets 69¢/100 g Pacific sole $3.90/kg Manitoba whitefish $0.32/100 g Fresh oysters $3.99/500 g

Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.	2. Develop, verify and use rules or expressions for the perimeter of polygons. [CN, PS, R]	2–5 Use unit cubes to build the objects shown in the following chart. Complete the chart.

Figure	Perimeter of Top	Area of Top	Surface Area	Volume
each dimension doubled				
each dimension tripled				
				
each dimension doubled 				
each dimension tripled				

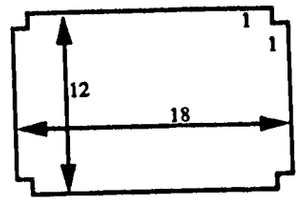
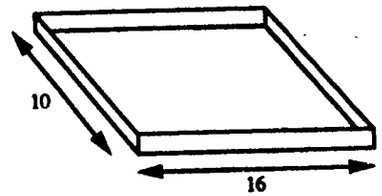
Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.		2.1 Domenico has forgotten one dimension of a room. What is the missing dimension. Three students each began to solve the problem. Domenico wrote: $P=L+W+L+W$ $46=16+W+16+W$ Jake wrote: $P=(2\times L)+(2\times W)$ $46=(2\times 16)+(2\times W)$ Owen wrote: $P=2(L+W)$ $46=2(16+W)$ Choose one boy's work and finish solving the problem. What is the missing dimension? Explain why you chose the work you did. 2.2 A triangular garden is a different length on each side. Side two is 3 metres shorter than side one, and side three is 8 metres longer than side one. If the perimeter of the garden is 65 metres, what is the length of each side?

Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.	3. Develop, verify and apply rules or expressions for the area of rectangles (mm^2, cm^2, m^2, ha and km^2). [CN, PS, R]	3.1 Four loonies are arranged as shown: The centres of the loonies are the vertices of a square. If the radius of a loonie is 13 mm, what is the area of the square? 3.2 Measure a football field, and use the measurements to calculate its area in hectares.
	4. Estimate and determine the surface area of a right rectangular prism, without using a formula. [E, PS]	4–5 Carefully observe a drink box. Then estimate: – the surface area of the box in square centimetres – the volume of the box in cubic centimetres. Measure the three dimensions. Explain how to use the dimensions to mentally estimate – the area of a grid paper jacket for the drink box – the volume of the drink box. Use centimetre cubes to explain how to calculate the volume of the drink box. Design a centimetre grid paper jacket to cover the box, and use the jacket to explain finding the surface area of a rectangular prism. 4.1 Explain how to find the surface area of a rectangular prism.

Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.	5. Discover, generalize and use rules for the volume of right rectangular prisms. [PS, R]	5.1 A manufacturer of open boxes has a large supply of cardboard sheets, 12 units by 18 units in length. The box-making machine can be set to cut square corners from each sheet before folding it to make an open box.   What is the volume of the box, if a 1 by 1 unit square is cut from each corner? Use centimetre paper to build a box with a 2-unit square cut from each corner. What is the volume of this box? Build and/or calculate the volume of all possible open boxes. What size of square should be cut from the cardboard sheets, if the open box is to have the greatest possible volume? Complete the chart to justify your answer.
		Size of Square Cut Outs / Length of Box / Width of Box / Volume of Box
		5.2 Use a large, graduated cylinder to determine the volume of a bunch of grapes. A grape is about 8 times the size it will be if it is dried to form a raisin. What might be the dimensions of a snack box designed to hold your bunch of grapes, after it becomes raisins? Explain your reasoning.
	6. Design and construct rectangles, given one or both of perimeter and area, using whole numbers. [PS, R]	6–7.1 Loretta wants to put 12 small square tables together to make one larger rectangular table to use for a class party. She is using square tiles to experiment before she moves the tables. Use 12 tiles to find all possible arrangements. Use grid paper to record your solutions. Make a chart to show each solution. What is the area of each large table? What is the perimeter of each large table? Which one has the least perimeter? Try the same experiment with 15 tiles, 24 tiles, 30 tiles. Compare your results. Is there a relationship between the shape of a table and its perimeter?
	7. Demonstrate concretely, pictorially and symbolically that many rectangles are possible for a given perimeter or a given area. [CN, R]	

Grade 6
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

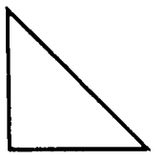
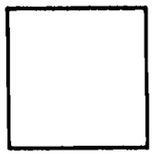
General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.		6–7.2 You are building a run in the backyard for your dog. You have 24 m of fence wire and you want the run to be the shape of a rectangle. – Make at least two drawings of rectangles that you could use that would require all the fencing. – Explain which one you would choose to build, and why.
	8. Determine the volume of an object by measuring the displacement of a liquid by that object (cm^3 or mL). [PS, R]	8.1 Bring a stone to class and determine its volume.
	9. Recognize angles as being more than 90 degrees, equal to 90 degrees, less than 90 degrees, equal to 180 degrees, greater than 180 degrees. [V]	
	10. Estimate and measure angles, using a circular protractor. [E]	10, 12 Use pattern block pieces and name the type of interior angle present in all blocks in the sets: Set 1—hexagon, trapezoid, blue and tan rhombuses Set 2—triangle, trapezoid, blue and tan rhombuses.
	11. Sketch and draw an angle when the degree measure is specified. [E, V]	Combine pattern block pieces to form new angles. Trace and label an example for each: – combine 2 blocks tc form an acute angle – combine 2 blocks to form an obtuse angle – combine 3 blocks to form a right angle – combine 5 blocks to form a straight angle.
	12. Classify given angles as acute, right, obtuse, straight and reflex. [E]	Demonstrate how to use a circular protractor to measure and name the angle in each answer traced above.

Grade 6
Strand: Shape and Space (Measurement)
Students will:

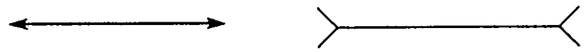
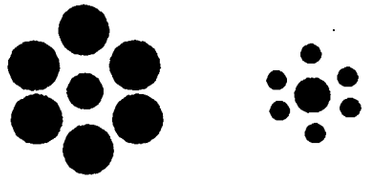
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving perimeter, area, surface area, volume and angle measurement.		10, 13 Visualize angle *ABC* when you are *B*, the teacher's desk is *A*, and the classroom door is *C*. About what size is the angle? How can you check your estimate? 10.1 Sketch and label a pizza that has been sliced to reveal these angles: 1—30°; 1—60°; 1—90°; 1—180°. Which piece would you be least likely to choose? Explain why. 10.2 Determine the approximate and exact measures of the angle between the hour hand and the minute hand when the clock reads 1:15.
	13. Identify and compare examples of angles in the environment. [CN, V]	13–14 Look at, or research business signs, logos, flags, etc. How common is it to see triangles in these creations? Name any triangles, according to their angles. Continue the search by observing art works and crafts. How are triangles used in quilting? Wallpaper designs? Stained glass windows? Use triangles in a creative work of your own. Present your work, describing what triangles you used.

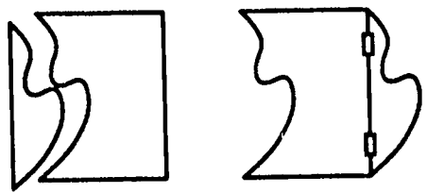
Grade 6
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use visualization and symmetry to solve problems involving classification and sketching.	14. Classify triangles according to the measures of their angles. [C, E]	14–15 – Give as many similarities and differences about these figures as you can. – Draw a figure that you think is like Figure 1. Explain why you think it is like Figure 1.  Figure 1  Figure 2 14.1 On a geoboard, create as many different triangles as possible. Record the different (not congruent) triangles on grid paper, making sure not to repeat. Keep one triangle on the geoboard. With the rest of your class, sort these triangles by angle measure.
	15. Sort quadrilaterals and regular polygons according to the number of lines of symmetry. [V]	15.1 You have been given four, 10-cm straws; four, 20-cm straws; and four pieces of pipe cleaner to act as corners. Construct, and draw quadrilaterals with: 0 lines of symmetry, 1 line, 2 lines, 3 lines, 4 lines. Look at your drawings. Can you predict the number of lines of symmetry a shape will have? Take four more 10-cm straws. Will your prediction work for regular polygons with 5 to 8 sides?
	16. Reproduce a given geometric drawing on grid paper. [V]	16.1 Sketch a 1-cm grid onto a picture having a geometric design. Reproduce the picture on a larger scale grid paper.
	17. Sketch 3-D solids and skeletons with and without grids. [PS, T, V]	17.1 A single serving cereal box is 9 cm wide, 3 cm deep and 12 cm high. Use grid paper to draw a picture of the box. A larger box of the same cereal is three times as wide, deep and tall. Draw the box to actual scale on a large, plain sheet of paper. 17.2 Sketch a 3-D statue, monument, or sculpture found in your community. What polygons or polyhedra help to guide your lines? Explain. 17.3 Use isometric dot paper to draw the skeleton of a triangular prism. Use plain paper and a ruler to draw the skeleton of a triangular pyramid.

Grade 6
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use visualization and symmetry to solve problems involving classification and sketching.	18. Recognize and appreciate optical illusions. [V]	18.1 Which is shorter?  18.2 Which centre circle is larger? 

Grade 6
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create patterns and designs that incorporate symmetry, tessellations, translations and reflections.	19. Create, analyze and describe designs, using translations (slides) and reflections (flips). [C, T, V]	19.1 Raj cut away one side of a regular polygon to make a new shape. Then he slid the shape to the opposite side and fastened it securely with tape. He says the new shape will tessellate and his method of decorating the shape will result in a "cool" tiling pattern. Investigate Raj's shape. Try your own tessellation, complete with unique decorating and colouring. Could the shape actually tile a surface? Report your work in an oral presentation to the class. 
	20. Draw designs, using ordered pairs, in the first quadrant of the coordinate grid. [PS, V]	20.1 Plot these points on a coordinate grid. $A(1, 5)$ $D(6, 3)$ $B(1, 3)$ $E(6, 1)$ $C(2, 3)$ $F(5, 1)$ Describe what combination of translations, rotation and/or reflections would move triangle ABC to the position of triangle DEF. Make up a problem with quadrilaterals in place of triangles. 20.2 Plot these points on a coordinate grid. $A(2, 2)$ $C(2, 5)$ $B(3, 3)$ $D(0, 3)$ Join the points A to B, B to C, C to D, D to A. Reflect the shape over a line drawn by joining (4, 0) to (4, 6). Name the location of points A', B', C' and D'.

Grade 6
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	1. Formulate questions for investigation, given a context. [C, CN, R]	1–4 You will often find a relationship between two different body measurements, such as the circumference of a person's head to his or her height. What are some key questions you might form to guide your investigation of body relationships? Can you predict what conclusion might be expected for each? Write and carry out a plan for investigating one of your questions above. Include information on the following: – sources of your data – sample size and makeup – method of data collection Find two different but satisfactory ways to display your data so any relationships between body measurements are revealed. Draw conclusions about your investigation, and compare them to your predictions.
	2. Identify appropriate data sources: first-hand, second-hand and combination. [R]	
	3. Select and use appropriate methods of collecting data: • designing and using structured questionnaires • experiments • observations • electronic networks. [C, PS, T]	1–2 It is Andrea's thirteenth birthday today. How many other students in Canada have their thirteenth birthday today?
	4. Select and defend the choice of an appropriate sample or population to be used to answer a question. [C, R]	4–5 Ray says the taller the basketball player, the more points she or he scores. Tell why each would or would not be an appropriate sample to use to verify his prediction. – NBA scoring leaders in the last 10 years – all basketball players on a local high school team – the centres on last year's provincial teams – the information he can find in a 1990 copy of *World Book Encyclopedia*.

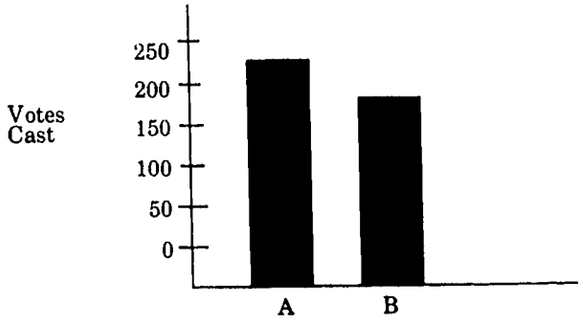
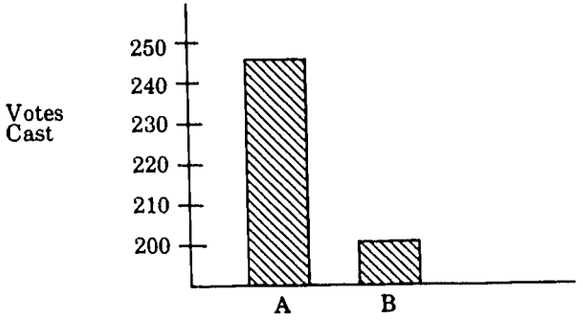
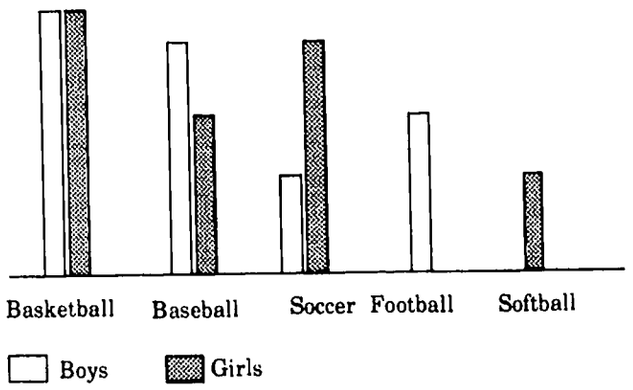
Grade 6
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	5. Discuss how collected data are affected by the nature of the sample, the method of collection, the sample size and biases. [C, CN]	5.1 Carmen designed and handed out 100 questionnaires to middle year students in her school. One question she asked was this: What do you want to be? Choose one. ☐ Doctor/Dentist ☐ Teacher ☐ Lawyer ☐ Sports Manager, Coach or Trainer 50 questionnaires were returned. Here are the results. Boys / Girls Doctor/Dentist: 𝍸 𝍸 / 𝍸 | Teacher: || / 𝍸 𝍸 | Lawyer: 𝍸 ||| / 𝍸 || Sports/Manager, etc.: 𝍸 / | Carmen reached the conclusion that most students will become doctors or dentists. Tell if you agree with each, and describe what else she might have done: - the wording of Carmen's question - the method of gathering data - the sample she chose to survey - the conclusion she reached.

Grade 6
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	6. Display data by hand or by computer in a variety of ways, including: • histograms • double bar graphs • stem and leaf plots. [C, T, V]	6.1 The following are the marks that a class got on the last mathematics test: 75, 65, 88, 92, 45, 47, 59, 74, 48, 96, 75, 56, 67, 69, 76, 59, 76, 58, 94, 55, 79, 89, 96, 86. Use a stem and leaf plot to display the data. 6.2 Annual precipitation in the various regions of Canada is shown below: Coastal regions 100 – 400 cm Ontario and Quebec 65 – 90 cm Prairie region 40 – 55 cm Northlands 15 – 40 cm Display the above data, using a suitable graph. Briefly describe why you chose the graph that you did. 6.3 The magazine *Sports Illustrated for Kids* asked many young people this question: "Have you ever played on a sports team where your mom or dad was coach?" These were the results: Yes 42.9% (dad) 5.2% (mom) 1.9% (both) No 50% Display the survey results on two different graphs. Give reasons for your choice of graphs.

Grade 6
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	7. Read and interpret graphs that are provided. [C, E, PS, R] 8. Describe the general distribution of data, using: • smallest and largest value • frequency • value in the middle • patterns. [C, CN] 9. Analyze sets of data to make comparisons. [E, PS, R]	7, 9 Two candidates (A and B) ran for election for school president in 1993. The graph at the left shows the results. One candidate used those results during the 1994 election campaign and prepared the graph at the right. Which candidate prepared the 1994 graph? How did the candidate misuse the information?  1993 Actual Results  1993 Results Used in 1994 Campaign 7.1 Our Favourite Sport to Play  What are some conclusions you can make from this graph? Explain your reasoning for each. What important information is not provided by this graph? Could this graph be true for the students in your class? Your school? Why?

Grade 6
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a po ation.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.		8.1 A Grade 6 class measured their heights to the nearest centimetre. 137 115 153 179 164 143 170 142 129 157 153 128 161 149 139 164 121 138 161 119 140 137 157 136 126 149 143 149 What are the least and greatest heights? What chart or graph would best reveal the two numbers? What height occurred more often than any other height? What chart or graph would best reveal this number? What height represents the middle of all the heights? How do you know? What chart or graph best reveals this?

Grade 6
Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Use numbers to communicate the probability of single events from experiments and models.	10. Distinguish between experimental and theoretical probability for single events. [PS, R]	10, 14 You have a cube with faces numbered 1 to 6. – What is the theoretical probability of rolling: a 6? A 4? A 1? – Perform an experiment with a die and compare the results.
	11. Make the connection between the number of faces, for various dice, and the probability of a single event. [CN, R]	11, 12 Draw and label the net of a die to match each statement. – The probability of rolling an odd number is $\frac{5}{6}$
	12. Calculate theoretical probability, using numbers between 0 and 1. [E, PS]	– The chance of rolling a prime number is $\frac{0}{4}$ – The likelihood of rolling a multiple of two is $\frac{5}{8}$
	13. Demonstrate that different outcomes may occur when repeating the same experiment. [PS, T]	13.1 Toss a styrofoam cup, repeatedly, on a flat surface. Note how many times it lands in each position. Keep a record for 40 tosses. – How many times did the cup land on its side? Top? Bottom? – How would you express each as a probability? Side? Top? Bottom? – Based on the results of the above experiment, predict how many times the cup would land on its top, if you tossed it 1000 times.
	14. Compare experimental results with theoretical results. [C, E, R]	

Grade 7
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for decimals and integers, including whole numbers.	1. Define and use power, base and exponent to represent repeated multiplication. [C, T, V]	1.1 If the base-10 blocks represent the first four powers of ten, what will the first four powers of two look like? Use centicubes to construct 3-D models. Use your models to explain the shape and size of the fifth and sixth powers of 2. Sketch a diagram of the six models. Label the dimensions, and write the total number of centicubes used in each. How will models representing the powers of three be like the models you have sketched? How will they be different? 1.2 Which is greater, 2^5, or 5^2? Explain your choice.
	2. Write a whole number as: • an expanded numeral, using powers of 10 • scientific notation, and vice versa. [C, CN, V]	2.1 The Sun has a diameter of about 1 382 400 km and is about 148 640 000 km from Earth. Write these numbers in the following two forms: – using expanded notation with powers of 10 and kilometres as units of length. – using scientific notation and kilometres as units of length. For what kind of numbers is the use of scientific notation most appropriate? How are the numbers affected, if metres are used as units of length? 2.2 The national debt of Canada in January 1995 was 5.46×10^{11} dollars. Express this in decimal notation.
	3. Use divisibility rules to determine if a number is divisible by 2, 3, 4, 5, 6, 9, 10. [CN, R]	3.1 There are nine players on a baseball team. If 365 people showed up for a tournament, and teams were made up, would there be anyone left over? – Use a divisibility rule to decide without dividing. – Represent the 365 people with base-10 blocks and explain why the rule for 9 works. (Hint: how many groups of 9 are there in 100 and 10?) 3.2 A bag of marbles can be divided into equal parts among 2, 3, 4, 5 or 6 friends (with none left over). What is the smallest number of marbles the bag can contain?
	4. Read and write numbers to any number of decimal places. [C, CN, V]	4.1 Carl saved his money and bought a mountain bike. His dad had given him $179.49, which was half the cost of the bike. Carl wrote a cheque for the full cost. Show how he wrote the amount in words and in numbers on the cheque.

Grade 7
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for decimals and integers, including whole numbers.		4.2 At his garage sale, Bryan priced comic books at 20 for $1.00. He wrote the price on each comic book as 0.05¢. Is this correct? Explain. 4.3 Enter the following numbers on your calculator. After you enter each number, press +. Two and one hundred four thousandths. Seven hundred five and seven hundred five thousandths. Fourteen and one hundred fourteen ten thousandths. Your calculator should now read 721.8204.
	5. Demonstrate and describe equivalent mixed numbers and improper fractions concretely, pictorially and symbolically. [C, R, V]	5.1 Hexagonal work tables can be separated into two half-tables that are trapezoidal in shape. Jamesie wants to make some work tables. He has 13 half-tables. How many work tables can he make? – Use pattern blocks to represent the trapezoidal and hexagonal tables and solve the problem. – Draw a diagram of your solution. – Use this model to explain how $\frac{13}{2}$ can be written as a mixed number. 5.2 A candy bar can be broken into six equivalent pieces. Zoe said she had $2\frac{4}{6}$ of these candy bars. Does Zoe have enough one-sixth pieces so that she and her 12 friends can each have a one-sixth piece? Use a manipulative to model and solve the problem. Write $2\frac{4}{6}$ as an improper fraction and explain your answer with the candy bar model.
	6. Compare and/or order improper fractions, mixed numbers and decimals to thousandths. [R, T, V]	6.1 Explain how you could order the following numbers from least to greatest, using a number line with the benchmarks of $\frac{1}{2}$ and 1. $\frac{3}{7}$, $1\frac{1}{3}$, $\frac{5}{9}$, $\frac{13}{12}$, $1\frac{4}{9}$ 6.2 Estimate the numerator of the fraction that satisfies: $0.45 < \frac{\square}{8} < 0.7$ Explain how you can use your calculator to verify your estimate.

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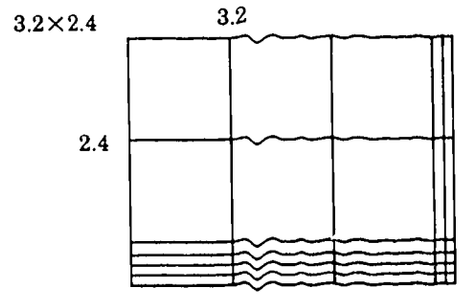
Grade 7
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for decimals and integers, including whole numbers.	7. Recognize and illustrate that all fractions and mixed numbers can be represented in decimal form (include terminating and repeating decimals). [R, V]	7.1 Juan was recording the results from probability experiments. The data were gathered as common fractions, but he wanted to write them in decimal form because it is easier to compare results that way. Whenever possible, he did it mentally, by finding an equivalent common fraction with a denominator that is a power of 10. Finish his work shown below. For which examples can you not use his mental method? Explain. $\frac{3}{5} = \frac{6}{10} = 0.6$ $\frac{13}{25} = ?$ $\frac{2}{3} = ?$ $\frac{5}{8} = ?$ $\frac{7}{12} = ?$ $\frac{13}{20} = ?$
		7.2 Sarah used her calculator to find the decimal equivalent for $\frac{1}{3}$. Show how she did this. Sarah then explained why the decimal repeats by trying to take $\frac{1}{3}$ of a base-10 thousand block. First, she traded it for 10, hundred flats and made 3 sets of 300. She then took one of the sets and said, "So far, I have three flats or 0.3 of the block, but there is a hundred flat left over." Can you finish the activity and explain why the decimal repeats?
	8. Convert from terminating decimals to fractions. [R]	8.1 Sometimes it is useful to write decimals in common fraction form. For example, it may be easier to visualize $\frac{1}{4}$ of a box of candy than 0.25 of a box. Show how you could write the following decimals as fractions in lowest terms. 0.245 1.62
	9. Convert from single-digit repeater ($0.\dot{3}$) decimal numbers to fractions, using patterns. [CN, R, V]	9.1 Bart used his calculator to express the following fractions as decimals: $\frac{1}{9} = 0.111\ldots$ $\frac{2}{9} = 0.222\ldots$ $\frac{3}{9} = 0.333\ldots$ Predict the decimals for $\frac{4}{9}$ and $\frac{7}{9}$. Predict what fraction will have 0.888... as a decimal. Check your predictions on your calculator. Can you explain the pattern in words?

Grade 7
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for decimals and integers, including whole numbers.	10. Demonstrate, concretely and pictorially, that the sum of opposite integers is zero. [R, V]	10–11 Play a game. Toss a red die and a green die together. For each toss, the red die shows how many points you win and the green die shows how many points you lose. Represent the points you win with red chips and the points you lose with green chips. If each point lost (green chip) can cancel a point won (red chip), show how you can find your score for each toss. How many ways could you get a score of zero (0)?
	11. Represent integers in a variety of concrete, pictorial and symbolic ways. [R, V]	
	12. Compare and order integers. [R, V]	12.1 Temperatures at a variety of places across Canada at 3:00 p.m. on a certain day were as follows: +8°C, −3°C, −7°C, 0°C, +3°C, −12°C, +10°C. Arrange the temperatures from lowest to highest.

Grade 7
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems.	13. Use patterns, manipulatives and diagrams to demonstrate the concepts of multiplication and division by a decimal. [CN, PS, R, V]	13.1 Revalue the base-10 blocks. For example, let the "flat" represent one. Then the "long" represents one tenth, and the "unit" represents one hundredth. The diagram below shows the multiplication 3.2×2.4.  Use base-10 blocks and this diagram to find the product and explain your procedure. 13.2 Jacques bought 13.2 m of fabric to make table cloths. Each cloth takes 2.4 m of fabric. How many table cloths can he make? Use base-10 blocks to find the answer. Explain how your answer is related to the answer you get on your calculator.
	14. Use estimation strategies to justify or assess the reasonableness of calculations. [E, PS]	14–15.1 Liam bought 3 equally priced CDs and a tape priced at $11.95. He paid $71.20 in total. What was the cost of each CD? Before you calculate the exact answer, explain why it must be less than $24.00.
	15. Add, subtract, multiply and divide decimals (for more than 2-digit divisors or multipliers, the use of technology is expected). [E, PS, T]	14–15.2 Apples cost $1.39 per kilogram. If you have $6.00, can you purchase a 3.75 kg bag of these apples? Explain how you could make an estimate to be sure, before you purchase the apples. Find the cost of the apples.

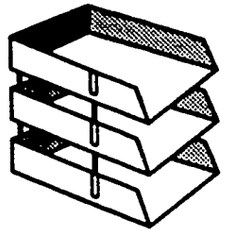
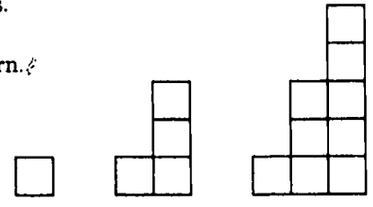
Grade 7
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems.	16. Add, subtract, multiply and divide integers concretely, pictorially and symbolically. [PS, V]	16.1 Show how you can use two different coloured cubes to represent the following numbers, and combine them. $+10 + -6$ $-4 + -7$ $-8 + +5$ 16.2 Calvin put equal numbers of white and black cubes in a container to make a neutral charge. He then put in 6 white cubes to make a charge of -6. From this container he removed four black cubes and wrote $-6 - +4 = -10$. Show why this is true and use a similar method to find: $+5 - -2$ $-3 - -5$ $+7 - +6$. 16.3 Hoang explained $+5 \times -2$ as putting 5 groups of 2 white chips each into a container for a product of -10. He explained $-6 \times +4$ as taking 6 groups of 4 black chips out of a neutral container for a product of -24. Using Hoang's reasoning, demonstrate and explain -3×-5 and $+7 \times +6$ 16.4 The temperature fell 2°C per hour for a total temperature change of -10°C. How many hours did this take? 16.5 Extend the following pattern, and describe the rule that is used. $-3, 6, -12, \ldots$
	17. Illustrate and explain the order of operations, using paper and pencil or a calculator. [PS, T, V]	17.1 Determine the missing operation signs so that the following statement is true. $(7.4 \square 2.1) \square 14 = 1.11$ 17.2 Place parentheses in the following equation to make it true. $4 + 5 \times 3 - 8 = 19$

Grade 7
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Illustrate the use of rates, ratios, percentages and decimals in solving problems.	18. Estimate and calculate percentages. [E, PS]	18.1 (Links to Data Analysis SO 7) Les Krantz, in his book called *What the Odds Are* found that men will suffer severe hair loss—baldness—by the time they reach the age ranges listed below: 20–29: 1 in 5 30–39: 3 in 10 40–49: 2 in 5 50–59: 1 in 2 60–69: 2 in 3 70–79: 3 in 4 How many men in every hundred would you expect to have lost most of their hair by the time they reach these age ranges? – 20 to 29 – 40 to 49 – 60 to 69 Predict the percentage of men between the ages of 80 to 89 who will be bald. Explain your reasoning for each prediction.
		18.2 You say that an increase from 5 to 20 is a 300% increase, then that means a decrease from 20 to 5 must be a 300% decrease. What is wrong with this reasoning?
		18.3 Almost 14% of Canada's land surface is covered by wetlands. If Canada's land surface is 1020 million hectares, how many hectares are covered by wetlands?
	19. Distinguish between rate and ratio, and use them to solve problems. [PS]	19.1 Travelling from Saskatoon to Regina, a distance of 276 km, took 3 hours. What was the rate?
	20. Explain, demonstrate and use proportion in solving problems. [C, PS, V]	20.1 Geela makes orange paint with 5 parts yellow to every 2 parts red. If she used 6 parts red, how many parts yellow would she need?
		20.2 Jenny read 26 pages in 2 hours. At that rate, how many pages would she read in 5 hours?
	21. Convert, mentally, among fractions, decimals and per cents to facilitate the solution of problems. [E, PS]	21.1 25% of the 600 people at the basketball game were with the visiting team. Use mental mathematics to find how many people were with the visiting team.

Grade 7
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.	1. Predict and justify possible *n*th values of a number pattern. [C, CN, R]	1, 5.1  Stacks of filing trays can be made by spacing the trays with riser rods. Four riser rods are needed for each space between the trays. How many riser rods are needed for a stack of: – 3 trays – 6 trays? Write a formula for the number of riser rods (r) in terms of the number of trays (t). 1, 5.2 Use cubes to copy and extend these hotels, according to the pattern up to the fifth hotel. Predict the total number of cubes needed for the 10th hotel, 25th hotel. Explain why. Develop a chart to record and reveal number patterns. Explain how your pattern grows. Write an open number expression to show your pattern.  Hotel 1 Hotel 2 Hotel 3

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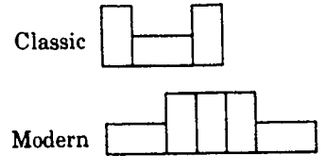
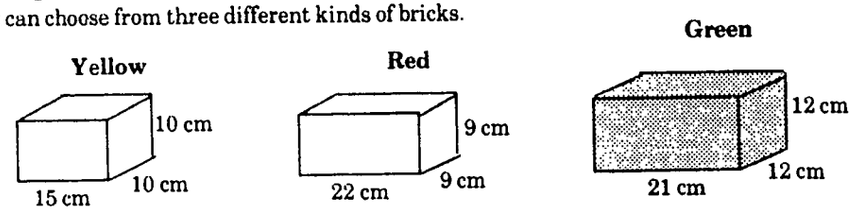
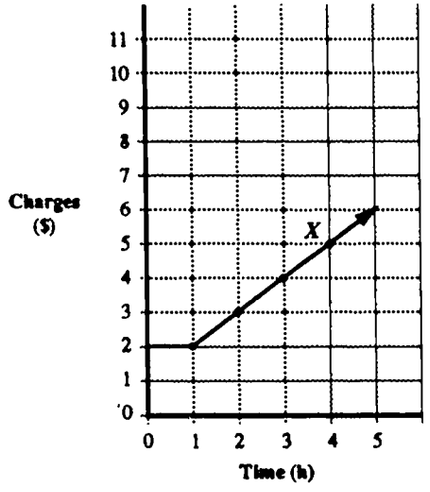
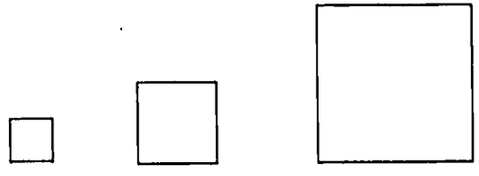
Grade 7
Strand: Patterns and Relations (Patterns)
Students will:

- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.		1, 5.3 Ms Fix would like to have a brick border for one side of her garden. She does not know yet which of the two basic patterns to choose: Classic or Modern.  In order to make the brick border long enough, she has to repeat the basic pattern a number of times. The length of the side of the garden is 14.20 metres. At the brickyard, Ms Fix can choose from three different kinds of bricks.  – Write a letter to Ms Fix in which you explain to her what to do. Include in your letter what bricks she can buy, how many, and justify your solution to her design problem. – Actually, Ms Fix wanted to have the Modern pattern, 25 times repeated along the side of her garden, but she cannot find bricks that she can use. What would be the dimensions of the brick she is looking for? Explain how you got your answer. – Write a rule, or a formula, that Ms Fix can use to find out how many bricks she needs for any length of a border, and for any kind of brick. Explain how your rule, or formula, works.

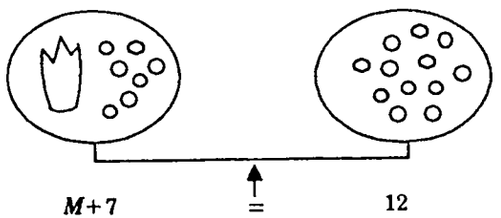
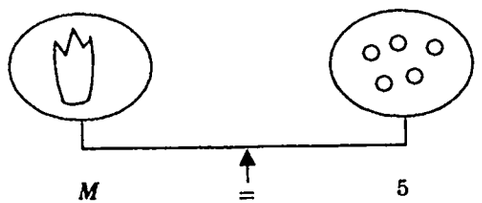
Grade 7
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.	2. Interpolate and extrapolate number values from a given graph. [E, PS, V]	2.1 This graph shows how much Mitch charges to babysit. How can you find out how much he would get paid for $2\frac{1}{2}$ h? Can you determine how much he would get for $\frac{1}{2}$ h? Explain. Explain, in words, how Mitch gets paid. Estimate how much he would get paid for 6 h. Extend the graph to check your estimate. How long did he babysit, and how much did he earn at the point X? 
	3. Graph relations, analyze the result and draw a conclusion from a pattern. [R, V]	3.1 Measure the sides of each of the squares provided. Find the perimeter of each square. Make a graph by plotting the length of the sides on the horizontal axis and the perimeters on the vertical axis. Describe the pattern in the graph. From the results of this graph, make a rule for finding the perimeter of a square. Explain how you could verify your rule. 
	4. Use patterns and relations to represent simple oral and written expressions as mathematical symbols, and vice versa. [CN, PS, R]	4.1 When you double Daniel's age and add 10, you get his mother's age. Write a mathematics expression that shows his mother's age. 4.2 If d represents the number of dogs in the park, what situation could $4d$ represent? $d-3$?

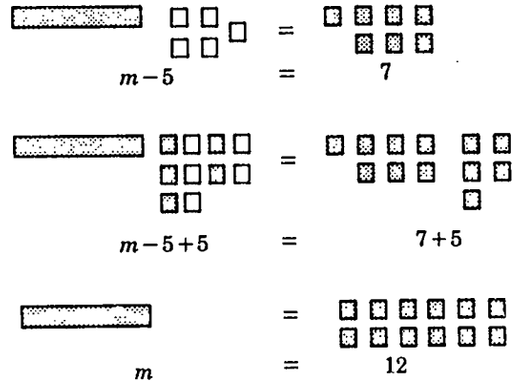
Grade 7
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.	5. Write mathematical expressions that arise from problem-solving contexts. [C, CN, PS]	5.1 An equal arm scale is balanced when there are three marbles on one pan and 410 g on the other. Write an equation to show this relationship.
	6. Evaluate expressions with and without concrete models. [R, V]	6.1 An expression for the mass of two cans and five marbles is $2c+5m$. Find the total mass, if each can has a mass of 200 g and each marble a mass of 75 g.
		6.2 A formula for finding the perimeter of a rectangle is $P=2(l+w)$. Find the perimeter when l is 8 cm and w is 6 cm.

Grade 7
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.	7. Illustrate the solution process for a one-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V] 8. Solve and verify one-step linear equations, using a variety of techniques. [PS, R]	7–9.1 Jill had some marbles in a bag. After Jay gave her 7 more, she had 12 marbles in all. How many marbles were in the bag? Jose wrote the equation $M+7=12$. He used a balance scale model to solve it. Let represent the marbles Jill originally had.  $M+7$ = 12 He took 7 marbles off each side.  M = 5 Jill had 5 marbles in the bag. Illustrate Jose's method in solving the following problem: Bill had six books. Teruko gave him some more, and then he had 10 books. How many books did Teruko give Bill?

Grade 7
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways

General Outcome	Specific Outcomes	Illustrative Examples
Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.	9. Explain how to solve simple problems, using informal algebraic methods. [C, PS, R]	7–9.2 Sharon had some money, she spent \$5 and then she had \$7 left. How much money did Sharon have to begin with? Ted wrote the equation $m-5=7$ and used algebra tiles to solve it.  $m-5 = 7$ $m-5+5 = 7+5$ $m = 12$ Sharon had \$12 to begin with. Use Ted's method to solve: Barb had some sports cards. She sold six and then she had 10 left. How many did she have to start with? 9.1 Nat had some stamps. He divided them into sets of six to put in his album. He made 17 sets. How many stamps did Nat have?

Grade 7
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving the properties of circles and their connections with angles and time zones.	1. Measure the diameters, radii and circumferences of circles, and establish the relationships among them. [CN, R]	1.1 Gunther gathered a variety of circular objects, such as container lids and wheels. For each object, he measured the diameter with calipers and the circumference with a tape measure. He started making this chart:

Object	Diameter (cm)	Circumference (cm)	Relationship between Diameter and Circumference
nut can lid			
bicycle wheel			
oat meal container			

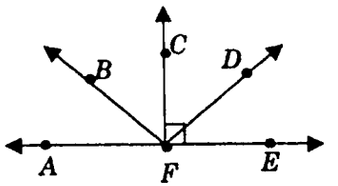
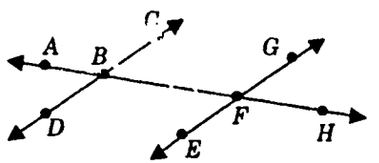
He noticed a pattern in how the two measures for each object were related.
Estimate the relationship between diameter and circumference. Test it by measuring the diameter of another object and predicting the circumference before measuring it.
Use your calculator to find the relationship in each case.
Make a rule that relates the diameter and circumference of a circle.

2. Solve problems involving the radii, diameters and circumferences of circles. [PS, T]	2.1 Elena is making a tablecloth for a round table with a diameter of 90 cm. She wants an overhang of 10 cm. What length of fringe must she buy to decorate the edge of the tablecloth?
	2.2 The point on the minute hand of a clock travels 132 cm each hour. How long is the minute hand?
	2.3 If my bicycle wheel is 70 cm in diameter, how far can I go in one revolution? In 10 revolutions? The radius of the wheel on my little brother's bike is 20 cm. How far does he go in one revolution?
3. Explain how time zones are determined. [C, PS]	3.1 Investigate how time zones are determined. Write some questions you want answered, and decide where you can get the information you need. (You may use school or community libraries or computer searches, for example.) Make a report on your findings.

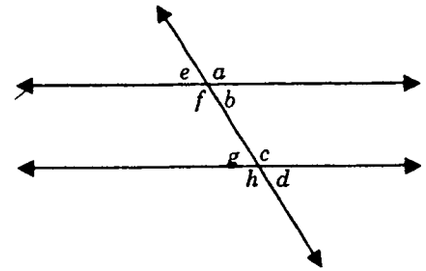
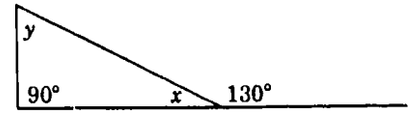
Grade 7
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Solve problems involving the properties of circles and their connections with angles and time zones.		3.2 Look at a map that shows the time zones in Canada. Why are the actual zones not all evenly spaced? 3.3 If you left Vancouver at 8:25 a.m. (Pacific Time) and arrived in Winnipeg at 1:40 p.m. (Central Time), how long was your flight?
	4. Research and report how measurement instruments are used in the community. [C, CN]	4.1 Make arrangements to visit businesses and services in your community. Prepare questions about how the people use measurement. Be sure to consider all types of measure: linear, volume, capacity, area, mass, time, angles, money. Look for common and unique measures and processes of measuring. Make a report on your findings.

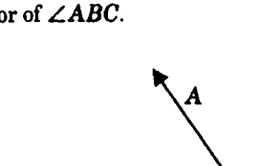
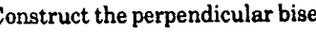
Grade 7
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Link angle measures to the properties of parallel lines.	5. Measure and classify pairs of angles as complementary or supplementary angles. [E]	5.1 In the diagram below, name a pair of complementary angles and a pair of supplementary angles.  5.2 Explain what is meant by complementary angles and supplementary angles, by drawing a pair of each.
	6. Investigate, identify and name pairs of angles pertaining to parallel lines and transversals, including: • corresponding • vertically opposite • interior on the same side of the transversal • exterior on the same side of the transversal • alternate angles. [C, V]	6.1 In the diagram below, name pairs of angles that are: – corresponding – vertically opposite – interior on the same side of the transversal – exterior on the same side of the transversal – interior alternate. 

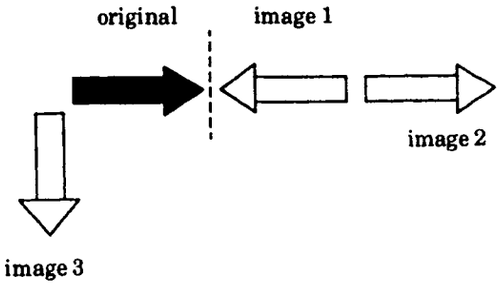
Grade 7
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Link angle measures to the properties of parallel lines.	7. Describe the relationships between the pairs of angles pertaining to parallel lines and transversals. [C, R, T]	7, 9 If a is 100°, calculate the measures of each of the other angles. Justify each calculation. 
	8. Explain, in more than one way, why the sum of the measures of the angles of a triangle is 180°. [C, R, T]	8.1 Myra drew several triangles of different sizes and shapes and cut them out. She marked the vertices and cut off the three vertices of each triangle. Make some triangles like Myra's, and explain how you can use the three vertices from each triangle to show that their sum is 180°.
	9. Use mathematical reasoning to determine the measures of angles in a diagram. [R, V]	9.1 Find the measures of the indicated angles in the diagram below. 

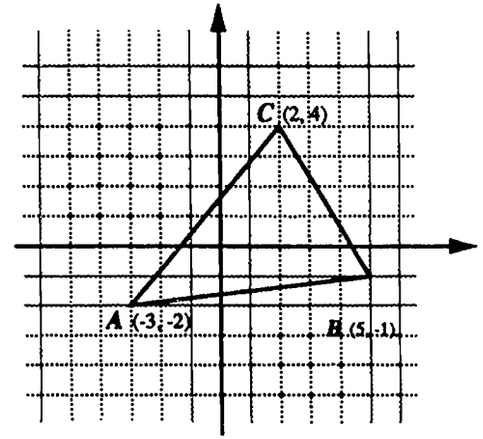
Grade 7
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Link angle measures to the properties of parallel lines.	10. Construct angle bisectors and perpendicular bisectors. [R, T, V]	10.1 Construct the bisector of $\angle ABC$.  10.2 Construct the perpendicular bisector of the line segment AB. 

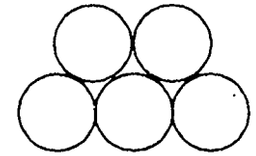
Grade 7
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.	11. Create, analyze and describe designs, using translations (slides), rotations (turns) and reflections (flips). [C, T, V]	11–12 The picture below shows three images of an arrow. Identify each transformation and explain how the image is the same and how it is different from the original figure.  11.1 Make a design by drawing this figure on paper and then making six slide images of the figure. Describe the direction and length of each slide motion so that someone else, given the same figure, can replicate your design. 11.2 Make a design by drawing this figure on paper and then making four turn images of the figure. Describe the turn centre, direction and degree of each turn so someone else, given the same figure, can replicate your design.

Grade 7
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.	12. Use informal concepts of congruence to describe images after translations, rotations and reflections. [C, T]	12–13 State the coordinates of *A*, *B* and *C* after the slide (R3, U4). Draw the image, and compare the image to the original triangle. 
	13. Draw designs, using ordered pairs, in all four quadrants of the coordinate grid, together with translation and reflection images. [PS, V]	13.1 A triangle has vertices (3, 2), (6, 2) and (6, 4). It is flipped into the second quadrant with the *y*-axis as the mirror line. This image is flipped into the third quadrant with the *x*-axis as the mirror line; and this image is flipped into the fourth quadrant with the *y*-axis as the mirror line. Draw the three images and give the coordinates of each vertex of each triangle. 13.2 The origin (0, 0) and the point *P* represent opposite vertices of a rectangle whose area is 32 square units. Give one set of possible coordinates for *P*. Move point *P* to another location so that the area remains at 32 square units. Explain why you chose the point you did.

Grade 7
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.	14. Relate reflections to lines and planes of symmetry. [CN, V]	14.1 Draw in and label the line(s) of symmetry.  14.2 Use a miraboard to show that a square has four lines of symmetry, but other rectangles have only two. 14.3 Ardith made a sphere with molding clay. She cut the sphere in half with a knife and placed a sheet of paper between the pieces to represent a plane of symmetry. Make a cube with molding clay and explain how you can show planes of symmetry.

Grade 7
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.	1. Formulate questions for investigation, from a real-world context. [C, CN, R]	1–4 Design a questionnaire containing five questions to obtain information you would like from your classmates. Have at least one question to collect numerical data. Survey 10 students, keeping track of the results. Complete the survey by giving the questionnaire to the remainder of the students. Compare your results from the first 10 with those from a survey of all Grade 7s, using the same questionnaire. What may account for any differences or similarities? Enter the data into a database, after setting up the necessary categories. Use some of the features of the database to output two or three different reports, using a variety of the information collected. Enter the numerical data into a spreadsheet and have the computer generate two or three different types of graphs. Which graph is most effective in displaying the information. Why? What conclusions can you draw from the data collected?
	2. Select, defend and use appropriate methods of collecting data: • designing and using questionnaires • interviews • experiments • research. [C, PS, T]	
	3. Describe issues to be considered when collecting data; e.g., appropriate language, ethics, cost, privacy, cultural sensitivity. [C, CN, R]	1–3 For each of these questions: – Is there a relationship between wrist circumference and height? – Does smoking cause lung cancer? – Does pet ownership enhance the quality of life for senior citizens? Explain what would be the most appropriate methods for collecting data. Identify potential ethical problems, need for sensitivity to personal and cultural beliefs, and cost when designing questions and collecting data.
	4. Display data by hand or by computer in a variety of ways, including circle graphs. [C, T, V]	4–8 Estimate how many minutes it took you to get to school this morning. Share this time with other members of your class. Collect and display the data appropriately. Defend your choices for collection and display. Determine the median time, calculate the mean time, and determine if there is a mode for the data. Are these measures of central tendency similar? Examine the data to determine and discuss the distribution. – Are there any extremely long or short times? – What factors; e.g., traffic, roads, method of travel, might account for extreme times, gaps or clusters? Could you use this information to predict what time most students leave for school in the morning? – For what reason could this information be important?

Grade 7
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.		4–7 It is well known that 6 + 6 = 12, but does one 12-sided die equal two 6-sided dice when they are thrown a number of times? Throw a 12-sided die 50 times, and record the results in a suitable chart. Throw a pair of 6-sided dice 50 times, and record the results in a second chart. The result to be recorded is the total of the two numbers appearing on the top faces. Graph the results. Answer the following questions. – Which die (12-sided or pair of 6-sided) gives the higher average score? – Are the shapes of the graphs the same or different for the two experiments?
		4, 5 Keep a record of all your activities in a typical school day (24 h). Decide on categories for which the activities can be reported in number of hours (sleeping is an activity). Make a circle graph to show your typical school day. Share and compare graphs with other students. How can someone else's graph be useful to you?
	5. Read and interpret graphs. [C, E, PS, R]	5.1 Find some graphs in your local newspaper. Working in a group, discuss the following questions. – Does the data give the information indicated? – Is the type of graph appropriate for the data? – Have scales, pictures or data groupings been selected to distort data? – Does the graph present data clearly? Is it visually appealing?
	6. Determine measures of central tendency for a set of data: • mode • median • mean. [PS]	6.1 One measure of central tendency for a set of five numbers is 23. What might the numbers be? Find an example for each measure of central tendency.

ade 7
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.	7. Determine measures of the distribution of a set of data: • range • extremes, gaps and clusters • quartiles. [PS]	6.2 Four students were going on a camping trip. They agreed to share the weight of all their supplies evenly but could not agree what fair loads would be. They weighed all their materials. Here is what they recorded. Tent 7.0 kg; Utensils 2.2 kg Guitar 5.3 kg; Charcoal 4.0 kg Axe 2.75 kg; Hammock 3.5 kg Camp stove 2.75 kg; Food 4.75 kg Four sleeping bags 1.75 kg (each) How close can you come to four fair loads?
	8. Interpolate from data to make predictions. [E, PS, R]	8.1 Collect data on the population of your school over the last 10 years. Graph the information. What would you predict the school population will be in six years? What trends do you see in the population? Can you suggest any reasons for these trends? Would enrollment figures suggest a need to increase the size of your school facility in the next ten years? Why or why not?

Grade 7
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- **use experimental or theoretical probability to represent and solve problems involving uncertainty.**

General Outcome	Specific Outcomes	Illustrative Examples
Create and solve problems, using probability.	9. Use a table to identify all possible outcomes of two independent events. [PS, R]	9, 10 For a picnic, Rosanna prepared some ham, some chicken and some cheese sandwiches. She also wrapped pieces of apple and cherry pie. Pauloosi picked a sandwich and a piece of pie. Make a table to show all the possible combinations of sandwich and pie that Pauloosi could have picked. Rosanna prepared 5 ham sandwiches, 6 chicken sandwiches and 4 cheese sandwiches. Pauloosi's favourite sandwich is chicken. If he chooses a sandwich without looking, what is the probability that it is chicken?
		9.1 Using a regular six-sided die and a coin, list all possible outcomes, if they are tossed together. How many possible outcomes are there?
	10. Create and solve problems, using the numerical definition of probability as favourable outcomes divided by possible outcomes. [PS, R]	10.1 In pairs, draw a card from a deck of playing cards and record its value, regardless of the suit. Replace the card and draw again, recording the results. After doing this experiment 20 times, calculate the probability of drawing a jack from a standard deck of cards. Compare your results with another pair. Calculate the probability of drawing a jack based on the combined results of the class. Compare the results from your pair with those of the class. Calculate the theoretical probability of drawing a jack from a regular deck of cards and compare it to the experimental results.

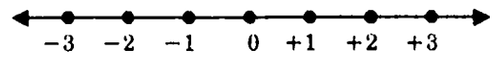
Grade 7
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Create and solve problems, using probability.	11. Use the Monte Carlo simulation method to solve probability problems. [CN, E, PS, T]	11.1 A breakfast cereal company has randomly placed one of four prizes in each cereal box it manufacturers. How many cereal boxes need to be purchased in order to be sure you will collect at least one of each prize. In order to use the Monte Carlo method to answer this question, use a spinner with four, 90° sectors or a four-sided die and complete a chart like the following to document the number of spins/throws required to get at least one of each 1, 2, 3 or 4, which represent each prize.

Trial	Prize 1	Prize 2	Prize 3	Prize 4	Total Spins/Throws
1	||||	|||	||||	|	12
2					
3					
4					
5					
...					

In Trial 1, there were 12 spins/throws required to get at least one tally mark in each column. This would imply that 12 boxes of cereal would need to be purchased in order to get at least one of each size. Try some more trials so you can answer the question.

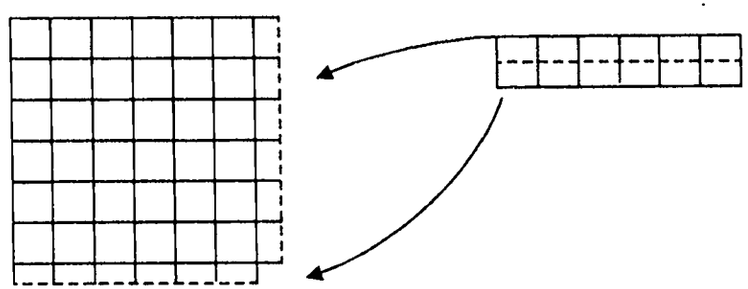
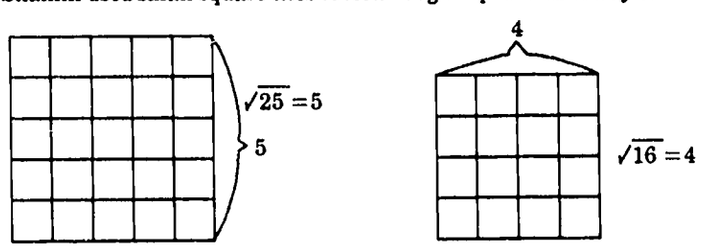
Grade 8
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.	1. Demonstrate and explain the meaning of a negative exponent, using patterns (limit to base 10). [C, CN, R, V]	1.1 Look for a pattern in both the top and bottom numbers. Continue the patterns. 100 000, 10 000, 1000, 100, 10, ___, ___, ___, ___ $10^5, 10^4, 10^3, 10^2, 10^1$, ___, ___, ___, ___ What is the connection between the two patterns? Make a rule to explain.
	2. Represent any number in scientific notation. [R]	2.1 The number of visitors to Banff National Park in 1989 was $4.032\,396 \times 10^6$, and the number of visitors to Kootenay National Park was 1 555 607. Which park had more visitors? How many more? Give your answer in standard notation. 2.2 If 5.03×10^{-5} was incorrectly written as 5.03×10^5, how many times larger is this? 2.3 The diameter of a human hair is 0.000 07 m. Write this number in scientific notation, using metres as the unit of measure. What is the diameter in centimetres?
	3. Define, compare and order any rational numbers. [R, T, V]	3.1 Show how you could represent and compare the numbers 0.34 and 0.43, using base-10 blocks when: – the cube represents one – the flat represents one. Explain why -0.43 is less than -0.34. 3.2 Explain where you would place each of the following numbers on the number line. $+1.75, -1.2, -\frac{6}{5}, +\frac{2}{3}$ 

Grade 8
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.	4. Demonstrate concretely, pictorially and symbolically that the product of reciprocals is equal to 1. [R, V]	4.1 Doris has $1\frac{1}{3}$ large pizzas left over from a party. At lunch the next day, her family ate $\frac{3}{4}$ of the leftovers. Doris said they ate one whole pizza in total. Use fraction circles to represent the pizzas to decide if Doris is correct. Explain why or why not. 4.2 Select appropriate Cuisenaire rods to explain why $\frac{4}{1} \times \frac{1}{4} = 1$. Draw a diagram to show what you did.
	5. Express 3-term ratios in equivalent forms. [CN]	5.1 Three classes have the same ratio of girls to boys. In Elisapee's class there are 6 girls and 5 boys. Bert's class has 15 boys and Karen's class has 12 girls. Show the equivalent ratios of girls to boys in Elisapee's , Bert's and Karen's classes. 5.2 A recipe calls for 250 mL of sugar, 500 mL of oatmeal and 750 mL of flour. Write the amounts of ingredients as a ratio. Write another equivalent ratio.
	6. Represent and apply fractional per cents, and per cents greater than 100, in fraction or decimal form, and vice versa. [CN, R]	6.1 John made a chart to illustrate per cents. He started with a large 10×10 grid. He folded it in half and shaded half the squares. He counted the shaded squares and wrote $\frac{50}{100} = 50\%$. He then folded the unshaded part in half and shaded the new half a different colour. He counted shaded parts and wrote $\frac{25}{100} = 25\%$. He did this three more times. Use a large grid to copy and complete John's work. Use the results from your work to show 150%, 212%, and $103\frac{1}{8}\%$. 6.2 How could you use 10×10 grid sheets to represent: $33\frac{1}{3}\%$, $166\frac{2}{3}\%$, 210%.

Grade 8
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.	7. Represent square roots concretely, pictorially and symbolically. [R, V]	7–8 Hannah used square tiles and grid paper to show that the square root of 42 is not a whole number. She made the largest square possible, using 36 of the 42 tiles, and traced a 6×6 square on grid paper. She then cut a strip of six squares to represent the six leftover tiles. She cut it and placed it on the grid, as shown below.  Estimate $\sqrt{42}$ from the diagram. Compare your estimate with a calculator result. Use Hannah's method to estimate the square roots of 56 and 130, and explain your solution. 7.1 Shamin used small square tiles to form larger squares as a way of finding the square roots of 25 and 16.  Use Shamin's method to show the square roots of 36, 49, 64 and 100.
	8. Distinguish between a square root and its decimal approximation as it appears on a calculator. [T]	

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on rational numbers to solve problems.	9. Add, subtract, multiply and divide fractions concretely, pictorially and symbolically. [E, PS, V]	9.1 Eric ordered several large pizzas for a party. $1\frac{1}{2}$ pepperoni pizzas and $\frac{2}{3}$ of a pineapple pizza were not eaten. Was there more than one large pizza left over? Explain how you can estimate the answer. Add $1\frac{1}{2}+\frac{2}{3}$, using a pencil and paper method, and use paper circles to explain your method and your answer. 9.2 Mr. Blair's gas tank was $\frac{7}{8}$ full when he left home. He used $\frac{3}{4}$ of a tank of gas on his errands. What fraction of a tank of gas was left? Explain how you know the answer is less than $\frac{1}{4}$ by subtracting $\frac{7}{8}-\frac{3}{4}$, using a pencil and paper method, and use fraction strips to explain your method and your answer. 9.3 Lisa had $\frac{3}{4}$ of a large candy bar. She gave $\frac{1}{3}$ of what she had to Shannon. Explain how you know that Shannon got less than $\frac{1}{3}$ of a whole bar by: - multiplying $\frac{1}{3}\times\frac{3}{4}$, using a pencil and paper method - explaining your method and your answer by folding a piece of paper that represents a whole candy bar. 9.4 Miko has $2\frac{1}{2}$ m of blue cloth. How many pieces $\frac{1}{4}$ m long can she cut from her piece? Estimate the answer and explain the solution by: - dividing $2\frac{1}{2}\div\frac{1}{4}$, using a pencil and paper method - using Cuisenaire rods to explain your method and your answer. 9.5 In the community hall, $\frac{1}{4}$ of the people present are men, $\frac{1}{3}$ are women and the rest are children. There are 840 people in the hall. How many children are there?
	10. Estimate, compute and verify the sum, difference, product and quotient of rational numbers, using only decimal representations of negative rationals. [E, PS, T]	10.1 Pam recorded the daily high temperatures for one week and found the average high temperature for the week to be -4.1°C. If the temperatures from Sunday to Friday were $+11.7$°C, -17.4°C, 0°C, -23.6°C, -13.9°C, and $+9.1$°C, what was the temperature on Saturday? Explain how you would estimate the answer. Calculate the answer and compare it with your estimate. 10.2 Réné spends half his money buying a ticket at the school dance. From one third of the money he has left, he buys himself a bag of chips and a soft drink. When he gets home, he has $4.50. How much money did he have when he went to the dance?

Grade 8
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply arithmetic operations on rational numbers to solve problems.	11. Estimate, compute (using a calculator) and verify approximate square roots of whole numbers and of decimals. [E, PS, T]	11.1 Steve knew the square root of 30 must be between 5 and 6 since 30 is between 25 and 36. He estimated it to be 5.6. He then used his calculator to find $(5.6)^2 = 31.36$. He then tried $(5.5)^2 = 30.25$ and $(5.4)^2 = 29.16$. He said 5.5 was the closest. Explain. Use Steve's method to find the square root of 40 to the nearest tenth and the square root of 20.5 to the nearest hundredth. 11.2 A domino is 2 squares side by side. If the area of the top is 882 mm^2, what are the dimensions of the domino?
Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.	12. Use concepts of rate, ratio, proportion and per cent to solve problems in meaningful contexts. [E, PS, T]	12.1 Have you read, or heard of, the book by Jonathan Swift called *Gulliver's Travels*? Gulliver, a ship captain, suffers a shipwreck, and finds himself in the land of Lilliput. Here he finds that the heights of the people, plants and animals are in a 1:12 ratio to the heights of the people, plants and animals in his world. Use the measuring tape to measure yourself. Then complete this chart.

Body Part	Actual Length	Length in Lilliput
Length of middle finger		
Length of your foot		
Your choice		

Each day the Emperor of Lilliput gave Gulliver the food and drink necessary to feed about 1 728 Lilliputians. How did the Emperor's mathematicians arrive at this number? Explain why this should be about the right amount.

12.2 Which is the better buy:
1.2 L orange juice for \$2.50 or 0.75 L orange juice for \$1.40?

12.3 Walter and Pat have the same ratio of cats to dogs in their kennels. Walter has 3 cats for every 5 dogs. Pat has 48 cats and dogs altogether. How many of Pat's animals are dogs?

12.4 [Relates to Data Analysis, Specific Outcome 4]
A class of 25 students has an average mark of 65% on a written test; a second class of 21 students has an average of 60%, and a third class of 23, an average of 67%. Find the average mark for all of the students.

Grade 8
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.	13. Calculate combined percentages in a variety of meaningful contexts. [CN, E, PS, T]	13.1 Suits selling regularly for $185.00 were marked down by 25%. To further improve sales, the discount price was reduced by another 15%. What was the final selling price? What was the total per cent of discount on the original price? 13.2 A store had a NO GST sale. Darcy purchased a skirt priced at $39.99. When she paid for it, the clerk first subtracted 7% to get a new price and then added 7% GST to this new price. Is this a fair way to calculate the price? Why would a store use this practice?
	14. Derive and apply unit rates. [PS, R]	14.1 Jerry bought 3.5 kg of apples for $5.25. What was the cost of 1 kg? 14.2 Toothpaste is advertised as 75¢ for a 50 mL tube. A 75 mL tube is priced at $1.09. Which is the better buy? Why?
	15. Express rates and ratios in equivalent forms. [PS, R]	15.1 Gas usage is expressed as the rate of number of litres of gas used per 100 km. On a 225 km trip, Nadia used 20.5 L of gas. Express her usage in terms of the above rate. Why do you think this type of rate is used? 15.2 Jelly powder was on sale for three packages for $1.68. Make a chart to show the cost of 6 packages, 9 packages, 12 packages. 15.3 In Canada, there are 1 million curlers registered in 1200 clubs. In Scotland, there are 50 000 curlers in 52 clubs, and in Sweden there are 9000 curlers in 36 clubs. Write a ratio for each to compare the number of curlers to the number of clubs, and arrange these in order of size from least to greatest.

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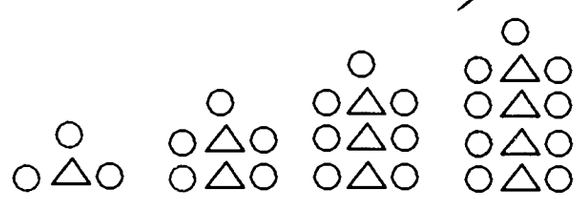
Grade 8
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Use patterns, variables and expressions, together with their graphs, to solve problems.	1. Generalize a pattern arising from a problem-solving context, using mathematical expressions and equations, and verify by substitution. [C, CN, PS, R]	1.1 Long-Foi made the following pictures with circles and triangles.  He started making a chart to show the number of circles and triangles in each picture.

Picture	Number of Circles	Number of Triangles
1	3	1
2	5	2
3		
4		

Complete Long-Foi's chart and look for a pattern.

Write a mathematics sentence to show the relationship between the number of circles and the number of triangles.
Make concrete models or pictures to verify your answers.
How many circles would you need in a picture with 12 triangles?
How can you find and verify the answer?
Substitute numbers in your sentence for each picture.

Grade 8
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Use patterns, variables and expressions, together with their graphs, to solve problems.	2. Substitute numbers for variables in expressions, and graph and analyze the relation. [C, PS, R, V]	2.1 Brock started making a chart to show the value of y when x changes for the expression $y=x+2$ x | 0 | 1 | 2 ... y | 2 | 3 | 4 ... Complete Brock's chart and make a graph to show the relationship. Analyze the graph.
	3. Translate between an oral or written expression and an equivalent algebraic expression. [C, CN]	3.1 Write an algebraic expression for the following: When a number is doubled and increased by seven, the result is twenty. 3.2 Describe the following algebraic equation in words. $\frac{x}{2}+5=x+2$ 3.3 Carl has 30 coins, all dimes and quarters. Write an expression to represent – the number of dimes, if he has x quarters – the total value of the coins.

Grade 8
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Solve and verify one-step and two-step linear equations with rational number solutions.	4. Illustrate the solution process for a two-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V]	4–6.1 Joe had 5 sports cards. He bought 3 packs with the same number of cards in each pack. If he now has 35 cards in all, how many were in each pack? Write an equation, and show how to solve it algebraically. Verify your answer by substituting it in your equation or by using algebra tiles. 4–6.2 Hans gave Vera half his marbles. She lost seven of the marbles Hans gave her and had 23 left. How many marbles did Hans have to start with? Write an equation, and show how to solve it algebraically. Verify your answer by substituting it in your equation or by using counters.
	5. Solve and verify one- and two-step, first-degree equations of the form: • $x+a=b$ • $ax=b$ • $\frac{x}{a}=b$ • $ax+b=c$ • $\frac{x}{a}+b=c$ where a, b and c are integers. [PS, V]	5–6.1 Kiotaka made 76 sandwiches for a party. If 29 were left over, how many were eaten? Write an equation and show how to solve it algebraically. Verify your answer by substituting it in your equation or by using base-10 blocks. 5–6.2 Kassidy bought five CDs at the same price each and paid a total of $84.45. How much did each CD cost? Write an equation, and show how to solve it algebraically. Verify your answer by substituting it in your equation. 5–6.3 Maria had a length of fabric to make banners. She divided the fabric into six equal pieces, and each piece was 2.75 m long. What was the length of the fabric? Write an equation, and show how to solve it algebraically. Verify your answer by substituting it in your equation or by using strips of grid paper.
	6. Create and solve problems, using first-degree equations. [PS] .	6.1 The following is some information that will be the basis of your constructing a word problem. It is 300 km from Regina to Gull Lake. About halfway between the two locations is Chaplin. Deleho drives her car the speed limit on No. 1 highway. Alain drives his convertible 10 km/slower than Deleho. Write two problems or questions based on this information.

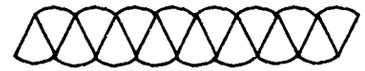
Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Apply indirect measurement procedures to solve problems.	1. Use concrete materials and diagrams to develop the Pythagorean relationship. [CN, R]	1.1 Tara is investigating the relationship among the three sides of a right triangle. She drew a right triangle in the middle of a sheet of paper and then constructed a square on each side of the triangle. Then she tried to cut the two smaller squares and fit them on the largest square. Try Tara's investigation, using right triangles with different shapes. Explain what you find.
	2. Use the Pythagorean relationship to calculate the measure of the third side, of a right triangle, given the other two sides in 2-D applications. [PS]	2.1 Jamie wants to walk from one corner of the rectangular playground to the opposite corner. The playground is 30 m by 50 m. What is the shortest route he can take? Explain.
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.	3. Describe patterns, and generalize the relationships by determining the areas and perimeters of quadrilaterals and the areas and circumferences of circles. [C, CN, PS, T]	3.1 The dimensions of five decorative gardens are given below. Which garden has the greatest area? – square with sides 10.2 m – rectangle with length 15 m and width 6.9 m – parallelogram with base 14.6 m and height 7.2 m – triangle with base 16.5 m and height 12.4 m – trapezoid with bases of 18.1 m and 10.4 m, and height 7.1 m. 3.2 Create a lake and island board by using the following directions: – a rectangular island *A* with an area of about 100 cm^2 – a triangular island *B* with an area of about 18 cm^2 – an irregular shaped island *C* with an area of about 50 cm^2 – a circular shaped island *D* with an area of about 25 cm^2. 3.3 You want to paint one wall of your room. The wall is 7.0 m long and 2.4 m high. It takes one small can of paint to cover 9 m^2 and the paint sells for $3.99 a can. – What would it cost you, if you purchase only paint? – What else do you need to think of? – Make a plan for your trip to the store for supplies for this painting job.

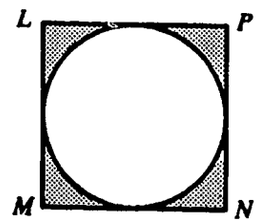
Grade 8
Strand: Shape and Space (Measurement)
Students will:
- **describe and compare everyday phenomena, using either direct or indirect measurement.**

General Outcome	Specific Outcomes	Illustrative Examples
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.		3.4 Melodie said that to find the perimeter of a triangle, you only have to measure one side and multiply by 3. Do you agree? Cut straws in several different lengths and make as many different triangles as you can. Use these straw triangles to explain your answer. Make a rule to find the perimeter of a triangle. 3.5 Trace a circle. Fold it in half four times to make 16 sectors. Cut out the sectors. Place the sectors in a line, alternating the bases to form a parallelogram. e.g.,  Show that the height is the radius of the circle and the base is half the circumference. Use this to find a rule for the area of a circle. 3.6 Aaron sketched some parallelograms on grid paper and cut them out. Then he cut a piece off one end of each parallelogram and fit it on the other side to form a rectangle. He made this chart:

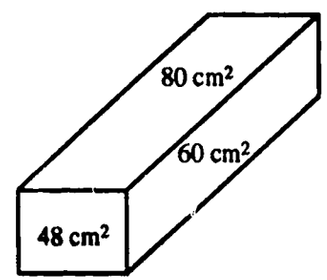
Base of Parallelogram	Height of Parallelogram	Area of Parallelogram	Base of Rectangle	Height of Rectangle	Area of Rectangle
3	4	12	3	4	12
2.5	3.5	8.75	2.5	3.5	8.75
1.5	4.2				
3	6.5				

Finish Aaron's chart, and look for a pattern. Test your pattern. Make a rule to find the area of a parallelogram. What other information should Aaron include on his chart to identify a pattern for finding the perimeter of a parallelogram?

Grade 8
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.		3.7 Yolande drew some triangles in different sizes and shapes. She then cut out two of each triangle. She fit each pair of triangles together to make a parallelogram. Try Yolande's investigation. Justify that each shape you make is a parallelogram. How can you use this investigation to make a rule for finding the area of a triangle? Do the same thing with trapezoids. 3.8 How many sides of a trapezoid must you measure to find the perimeter? Explain your answer. 3.9 The perimeter of the square *LMNP* is 60 cm. Find the: – diameter of the circle – circumference of the circle – area of the circle – area of the shaded region. 
	4. Estimate, measure and calculate the surface area and volume of any right prism or cylinder. [E, PS, T]	4.1 How much cardboard does it take to make a cereal box? Cut some cereal boxes to form nets. How many faces does each have? What shape are the faces? Are any of the faces the same size? How could you find the area of each face? Use the data you collected to make a rule for finding the surface area of a right prism. Use your rule to find which of your cereal boxes has the greatest surface area.

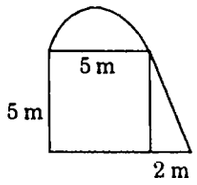
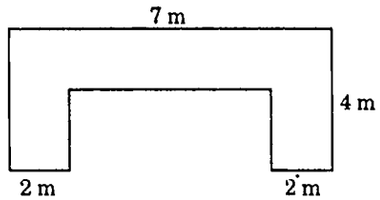
Grade 8
Strand: Shape and Space (Measurement)
Students will:
- **describe and compare everyday phenomena, using either direct or indirect measurement.**

General Outcome	Specific Outcomes	Illustrative Examples
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.		4.2 Collect some cardboard cylinders that have lids. Cut the cylinders to form nets. How many faces does each have? What shape are the faces? Are any of the faces identical? Could you find the area of each face? Use the data you collected to make a rule for finding the surface area of a cylinder. Use your rule to find the surface areas of your cylinders. 4.3 Wole had a jelly powder box and some centicubes. He first estimated how many cubes would fit in the box. Next, he filled the box, dumped out the cubes and counted them. How should Wole place the cubes in the box to get the most accurate measure? Explain. If Wole finds out how many cubes cover the bottom of the box, how can he use this information to find the volume of the box in cubic centimetres? Make a rule for finding the volume of a right prism. Test your rule with another prism. 4.4 Hugh had a small juice can and some centicubes. He first estimated how many cubes would fit in the can. Next, he filled the can with cubes, dumped them out and counted them. Is the volume (in cubic centimetres) he gets from this experiment larger or smaller than the actual volume? Explain. Hugh decided to find a way to get a more accurate answer. He traced the base of the juice can on some cm^2 grid paper and counted the number of squares inside the circle. What will this tell him? What else does Hugh need to do to find the volume of the cylinder? Make a rule for finding the volume of any cylinder. Test your rule with another cylinder. 4.5 The areas of the faces of a rectangular box are given in cm^2. What is the volume of the box? 

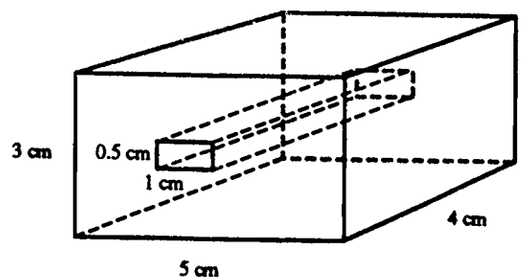
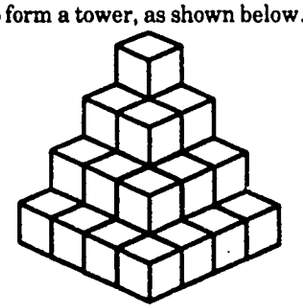
Strand: Shape and Space (Measurement)

Students will:

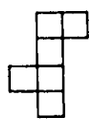
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.	5. Estimate and calculate the area of composite figures. [E, PS, R]	5.1 First estimate, and then find, the area of the figures below.  

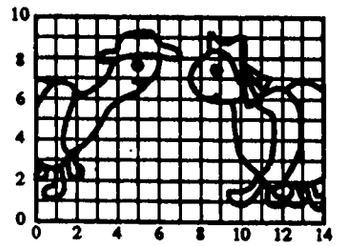
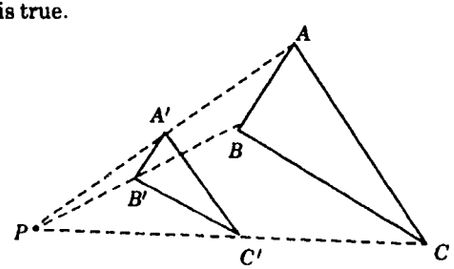
Grade 8
Strand: Shape and Space (Measurement)
Students will:
- **describe and compare everyday phenomena, using either direct or indirect measurement.**

General Outcome	Specific Outcomes	Illustrative Examples
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.	6. Estimate, measure and calculate the surface area of composite 3-D objects. [E, PS, R] 7. Estimate, measure and calculate the volume of composite 3-D objects. [E, PS, R]	6–7 First estimate, and then find, the volume and the surface area of the figure below. The figure is a 3 cm×4 cm×5 cm solid block of wood with a 1 cm × 0.5 cm ×4 cm hole cut in it  6.1 Thirty unit cubes are stacked in square layers to form a tower, as shown below.  Determine the total surface area of the tower of cubes. Suppose that the number of cubes and height of the tower are increased according to this pattern. Complete the table below for several specific towers. **Bottom Layer of Tower** **Total Number of Cubes** **Surface Area of Tower** 5 cubes by 5 cubes 8 cubes by 8 cubes 10 cubes by 10 cubes

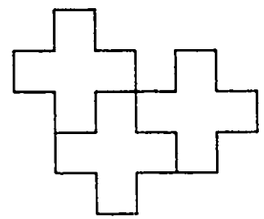
Grade 8
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Link angle measures and the properties of parallel lines to the classification and properties of quadrilaterals.	8. Identify, investigate and classify quadrilaterals, regular polygons and circles, according to their properties. [PS, R, T]	8.1 Investigate and describe the properties of intersections of diagonals of any quadrilaterals. Where possible, use computer software. 8.2 Identify, compare and debate the merits of shape in present and past architectural construction methods and decoration features; e.g., golden rectangle. 8.3 Given a variety of cutout polygons (regular and irregular with different numbers of sides); and circles (quadrilaterals should include irregular shapes, trapezoids, parallelograms, rectangles, rhombuses, squares and kites); find several ways to sort the figures and identify the characteristics of the subsets for each different way. 8.4 Take all the quadrilaterals from the set in 8.3. Sort them in different ways; e.g., number of parallel sides, number of right angles, number of congruent sides, number of congruent angles. Use sets of nesting boxes to show how the different kinds of quadrilaterals are related. 8.5 Draw five different rectangles. Devise a numerical measure of squareness that would allow you to rank your rectangles from the one most like a square to the one least like a square. Justify your choice.
	9. Build 3-D objects from a variety of representations (nets, skeletons). [PS, V]	9.1 Raymond cut this net for a cube from grid paper. How many different nets can you cut that make cubes?  9.2 Find two different nets for a cylinder. 9.3 Use toothpicks and molding clay to build prisms and pyramids with various polygons for bases.

Grade 8
Strand: Shape and Space (Transformations)
Students will:
- **perform, analyze and create transformations.**

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.	10. Represent, analyze and describe enlargements and reductions. [CN, R]	10.1 If the following figure is drawn on 1 cm grid paper, draw its enlargement on 2 cm grid paper.  10.2 The figure ABC is said to be reduced by $\frac{1}{2}$ to form the image $A'B'C'$. Use a series of measurements to show whether or not this is true.  10.3 Describe some everyday situations in which 2-D and 3-D enlargements and reductions are necessary or useful; e.g., photocopies, photographs, scale models, statues. Explain how the enlargement or reduction is the same and how it is different from the original figure or object; e.g., size, shape, proportion. 10.4 Darren had some small unit cubes. He used them to build larger cubes. What are the three smallest cubes Darren could build? How much larger is each one than the original unit cube? Explain, using cubes or a diagram. 10.5 Sandra was making squares with toothpicks for sides. What are the 3 smallest squares she can make? How much larger is each one than the square with one toothpick on each side? Explain your answer, using toothpicks.

Grade 8
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.	11. Draw and interpret scale diagrams. [PS, T]	11.1 Make a scale diagram of your bedroom or your classroom. In what units will you measure the room? What ratio will you use for your scale diagram? 11.2 Working in pairs, make a scale drawing of a sheet of ice at a curling rink, if the ice is a rectangle 44.5 m by 4.3 m and the scale is 1 cm : 3 m.
	12. Represent, analyze and describe regions and colouring problems. [C, PS, V]	12.1 The four-colour map theorem says that any flat map, no matter how many separate regions it has, can be coloured using only four colours, so that no bordering regions are the same colour. Cover a page with a design like the one below, and test the theorem. Also test the theorem with a real map, such as that of Canada, the United States or Europe. 

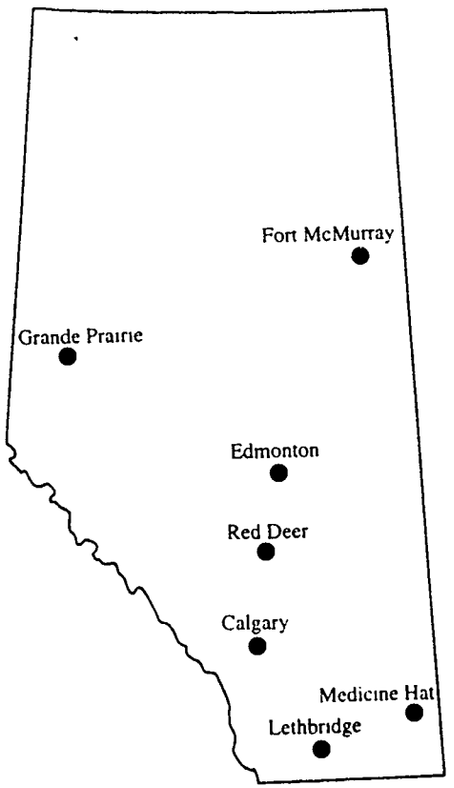
Grade 8
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.	13. Describe, analyze and solve network problems; e.g., bus routes, a telephone exchange. [C, E, PS]	13.1 On a map of Canada, mark the cities Whitehorse, Victoria, Edmonton, Yellowknife, Regina and Winnipeg. Devise an airplane network so that you can get from any one of these cities to any other one of them by changing planes, at most, once. Each route can have no more than two stops. You want the least number of routes. 13.2 Truck routes must connect Grande Prairie, Fort McMurray, Edmonton, Red Deer, Calgary, Lethbridge and Medicine Hat. The design must use the fewest number of trucks possible, and no truck must be driven more than 1100 km in any 24-hour period. In addition, the total number of kilometres driven nightly must be kept to a minimum. Use coloured pins and threads, on a map, to help you keep track of the routes. The following table shows the kilometres between major cities in Alberta.

From/To	Grande Prairie	Fort McMurray	Edmonton	Red Deer	Calgary	Lethbridge	Medicine Hat
Grande Prairie	0	720	460	620	760	985	1010
Fort McMurray	720	0	445	605	745	970	990
Edmonton	460	445	0	160	300	525	550
Red Deer	620	605	160	0	140	375	420
Calgary	760	745	300	140	0	225	280
Lethbridge	985	970	525	375	225	0	170
Medicine Hat	1010	990	550	420	280	170	0

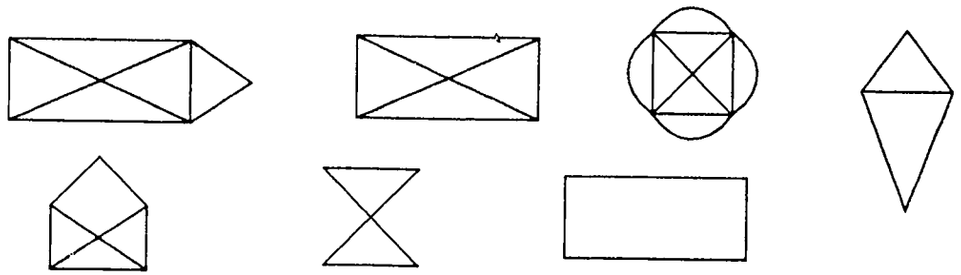
Your task is to design a route network, draw the routes on the Alberta map shown on the next page, state the number of trucks used, and calculate the number of kilometres driven each night.

Grade 8
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.		Finished work: Map of Alberta with truck routes marked:  Number of trucks used: _____ Kilometres driven each night: _____

Grade 8
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.		13.3 A network consists of vertices (points) and arcs that join them. A vertex is called even or odd, depending on whether or not an even or odd number of arcs are connected to it. Kwigah tried to trace each of the networks below without lifting his pencil or retracing any arcs. He made a chart of his findings. Trace the network and fill in Kwigah's chart. Can you find a pattern?



Number of Even Vertices	Number of Odd Vertices	Can the figure be traced?

Based on the pattern you find, draw a network that can be traced and one that cannot be traced.

13.4 Research the famous problem of the Bridges of Koenigsberg, and make a report.

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Develop and implement a plan for the collection, display and analysis of data, using technology, as required.	1. Formulate questions for investigation, using existing data. [C, CN, R]	1–3 How much household garbage is produced in our homes? In the average home in Canada? Design a questionnaire to investigate this problem. Justify your questions. Explain how you will carry out this survey. Could you collect data via computer networking? How can you use a computer to record, organize and display your data?
	2. Select, defend and use appropriate methods of collecting data: • designing and using surveys • research, using electronic media. [C, PS, T]	1.1 Find some data collected and presented in a local newspaper that are related to a current civic, regional or health issue. Do the data seem to support the conclusions the newspaper makes? Are the data presented in a fair, clear and appropriate manner? What questions about the issue are not addressed?
	3. Display data by hand or by computer in a variety of ways, including box and whisker plots. [C, T, V]	3, 5.1 Play a memory game with your class. Write 16 words on the board or overhead projector. Let everyone look at them for 2 minutes. When the time is up, each person writes as many words as he or she remembers. Collect the data (number of words remembered). Find the median and quartile scores, and make a box and whisker plot. Why is this method of displaying variability useful?
		3, 5.2 Using published data, find the life expectancy for females of 20 different countries. Graph the results, using a box and whisker plot.
Evaluate and use measures of central tendency and variability.	4. Determine and use the most appropriate measure of central tendency in a given context. [CN, PS, T]	4.1 Explain why each of the following people might select the mean, median or mode in a set of data. – A store owner deciding what sizes of shoes to order. – Someone moving to a new city and looking at housing costs. – Reporting the average score on a test.
	5. Describe the variability of data sets, using such techniques as range, and box and whisker plots. [C, PS, T]	

Grade 8
Strand: Statistics and Probability (Data Analysis)

Students will:

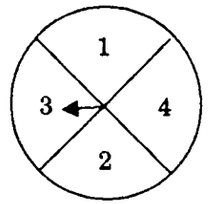
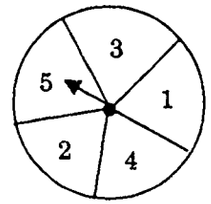
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Evaluate and use measures of central tendency and variability.	6. Construct sets of data given measures of central tendency and variability. [PS, R]	6–7 The mean score on a test was 5. The median was also 5, but the mode was 6. The 13 scores ranged from 2 to 10. Construct a set of scores that have the above measures. Represent each score with centicubes or unifix to show the measures concretely. Another score of 15 is added to the data. How will this affect each of the above measures? 6.1 Janice is sales manager in a department store. She must maintain average (mean) daily sales of at least $8500. Sales for the first four days of the week are $7530, $8475, $6550 and $7155. The store is not open on Sunday. What sales will Janice need to make on Friday and Saturday to come in over the target? Discuss whether or not it is likely that Janice will achieve her target. 6.2 The mean mark on four tests is 78%. What mark is needed on the next test to increase the mean to 80%? 6.3 State seven prices, where the median is $3.00, the highest price is $20.00, and the lowest price is $1.00.
	7. Determine the effect on the mean, median and/or mode when: • a constant is added or subtracted from each value • each value is multiplied or divided by the same constant • a significantly different value is included. [E, PS, R]	7.1 The number of passengers in different buses was recorded. The mean was 46 and the median was 47. If 20 extra passengers rode on each bus, what would the new mean and median be? If each passenger paid $1.25 to ride the bus, what would be the mean and median amount of money collected?

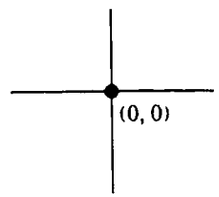
Grade 8
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Compare theoretical and experimental probability of independent events.	8. Use computer or other simulations to solve probability and data collection problems. [E, PS, T]	8.1 Draw vertical lines on large chart paper exactly two toothpick lengths apart. Toss 100 toothpicks randomly. Record any toothpick that touches a line as a "hit". Calculate the ratio between the number of tosses and the number of hits. Compare results. As more trials are attempted, the outcome will converge on π. Experiment with differing spaces between the lines as well as with different sticks. 8.2 A soft drink company placed a lucky liner in the caps of half their 1-L bottles. Derek said he bought five bottles and they all had lucky liners. How could you use computer-generated random numbers to simulate the situation and find the probability of getting the five lucky liners? 8.3 What is the probability of having exactly two boys in a family of five children? Design a simulation, using coins to answer the question.
	9. Recognize that if n events are equally likely the probability of any one of them occurring is $\frac{1}{n}$. [R]	9.1 If you toss one standard die, what are the possible events? Are they equally likely? Explain. Write the probability of tossing a 4. If you did the same experiment with a 12-sided die, what would be the probability of tossing a 4? 9.2 If you draw a card from a deck, what suit could it be? Are all suits equally likely? What is the probability of drawing a heart?

Grade 8
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:
- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Compare theoretical and experimental probability of independent events.	10. Determine the probability of two independent events where the combined sample space has 52 or fewer elements. [PS, R, V]	10.1  Spinner A  Spinner B A number spun on Spinner A is multiplied by a number spun on Spinner B. Calculate the expected probability of the product being: – 5 or less – even – a multiple of 5 – 1. Draw a diagram or table to help explain your reasoning. 10.2 Players in a dice game threw two dice each. A player wins, if the total is exactly 11. What is the probability of winning? 10.3 If you toss two dice, and find the sum, what are the possible sums? Are they equally likely? Explain. Give an example of two sums that are equally likely. What sum has the same probability as 10?
	11. Predict population characteristics from sample data. [C, CN]	11.1 A jar contains red and white jellybeans. There are 1000 jellybeans in all. Explain how you could draw samples from the jar, and use them to predict the number of red jellybeans in the jar.

Grade 9
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Explain and illustrate the structure and the interrelationship of the sets of numbers within the rational number system.	1. Give examples of numbers that satisfy the conditions of natural, whole, integral and rational numbers, and show that these numbers comprise the rational number system. [C, CN, PS, R]	1-2 Explain why 6 belongs to the natural, whole, integral and rational numbers. Explain why -4 is a rational number but not a whole number. Give an example of a number that is an integer but not a whole number. Explain. Draw four boxes that nest inside one another. Label each box as natural numbers, whole numbers, integers or rational numbers to show how the number systems are "nested".
	2. Describe, orally and in writing, whether or not a number is rational. [C, R]	2.1 The ratio of the circumference to the diameter of any circle is π. Explain whether or not π is a rational number.
	3. Give examples of situations where answers would involve the positive (principal) square root, or both positive and negative square roots of a number. [C, CN, PS, R]	3.1 What two values satisfy $x^2 = 16$? 3.2 If you wanted to find the length of one side of a garden whose area is 25 m^2, explain why you would use only the positive square root of 25. 3.3 A square has one corner at (0, 0) and an area of 36 square units. Find the possible coordinates of the other vertices. 

Grade 9
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense of powers with integral exponents and rational bases.	4. Illustrate power, base, coefficient and exponent, using rational numbers or variables as bases or coefficients. [R, V]	4.1 What is the value of the coefficient in the expression $-x^4$? $\frac{x^2}{5}$?
		4.2 Use cubes or draw diagrams to represent and explain the difference between 2^3 and 3^2.
	5. Explain and apply the exponent laws for powers with integral exponents.	5.1 Explain, orally and in written form, why $2^3 \times 2^5 = 2^8$. Give other examples of multiplication of powers with the same base. What is the pattern? Generalize to variable bases and exponents.
	$x^m \bullet x^n = x^{m+n}$	5.2 Use the exponent laws, and guess and test to find values for n.
	$x^m \div x^n = x^{m-n}$	$n^4 \times n^2 = 64$ $\quad n^{-5} = \frac{1}{32}$
	$(x^m)^n = x^{mn}$	$n^5 \div n^3 = 25$
	$(xy)^m = x^m y^m$	$(n^2)^3 = 729$
	$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, \ y \neq 0$	
	$x^0 = 1, \ x \neq 0$	
	$x^{-n} = \frac{1}{x^n}, \ x \neq 0$	
	[PS, R]	

Grade 9
Strand: Number (Number Concepts)
Students will:
- use numbers to describe quantities
- represent numbers in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Develop a number sense of powers with integral exponents and rational bases.	6. Determine the value of powers with integral exponents, using the exponent laws. [PS, R]	6.1 Explore the values generated by 2^3, 2^2, 2^1, 2^0, 2^{-1}, 2^{-2}, etc., using a calculator. What would the next number in the sequence be? What is the calculator doing to get this? How does 2^3 compare with 2^{-3}? What is the meaning of the negative exponent? Use a similar pattern to explain the difference between 4^3 and 4^{-3}. 6.2 Explain why some calculators give a different answer for $(-2)^4$ and -2^4. 6.3 Explain how you could estimate the value of $(2\times3)^3$. Compare your answer with your calculator answer. 6.4 Which is greater, 2^{-5} or 5^{-2}. Explain your reasoning. Compare your answer with your calculator answers. 6.5 If the price of a hamburger doubles every two years, what would it cost in 100 years? Find an alternative way of solving this, using exponents.

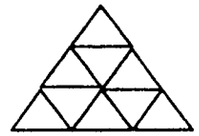
Grade 9
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Use a scientific calculator or a computer to solve problems involving rational numbers.	7. Document and explain the calculator keying sequences used to perform calculations involving rational numbers. [C, PS, T]	7.1 The set of keystrokes for the calculation $(21.3-14.7)\times(14.7+3.6)$ could be $21.3-14.7=$ [M+] C $14.7+3.6=\times$ [MR] $=$ for a total of 24 keystrokes. Devise another keying sequence that uses fewer key strokes. 7.2 Do the following calculation with as few keystrokes as possible. The calculation to be done is $\frac{21.6}{12.3\times(14.5-7.9)}$, which has the answer of 0.2660754. – Devise one way of obtaining this answer on your calculator. Write down the keystrokes that you used, both digit and operation keys, and record the number of keystrokes. – Now devise another method. Which method uses fewer keystrokes? Again, write down the keystrokes that you used, both digit and operation keys, and record the number of keystrokes used. – Explain each keying sequence, and explain why one of the sequences uses fewer keystrokes.
	8. Solve problems, using rational numbers in meaningful contexts. [CN, PS]	8.1 A swimming pool is filled by means of three pipes. The first pipe, by itself, can fill the pool in 8 hours; the second, by itself, can fill it in 12 hours; and the third pipe, by itself, can fill the pool in 24 hours. When all three pipes are in use at the same time, how long does it take to fill the pool?
Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.	9. Understand and use the exponent laws to simplify expressions with variable bases and evaluate expressions with numerical bases. [PS, R]	9.1 Using each of the digits from 1 to 5 only once, write the largest and smallest power possible. 9.2 What are the last two digits of 11^{100}? Explain how you arrived at your answer. 9.3 Use the exponent laws to simplify: $\frac{51x^{-4}y^{6}}{17x^{2}y^{-2}}$. Leave your answer in the form $ax^{b}y^{c}$ where a, b and c are integers. 9.4 Evaluate $\frac{5^{3}}{5^{2}}\times\frac{4^{6}\times4^{-2}}{(4^{2})^{2}}$.

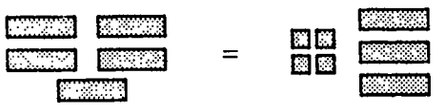
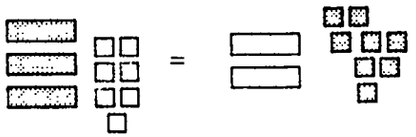
Grade 9
Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

General Outcome	Specific Outcomes	Illustrative Examples
Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.	10. Use a calculator to perform calculations involving scientific notation and exponent laws. [PS, R, T]	10.1 Explain the keystrokes you could use to do the following on your calculator: $(5.1\times10^{6})\times(2.34\times10^{-2})=$ 10.2 The estimated mass of one of the smallest living organisms is 1.0×10^{-16} g. Write this mass in decimal notation. How many organisms are needed to have a mass of 1 g? 10.3 The Moon is 3.84×10^{5} km away. The circumference of the Earth at the equator is 4.0×10^{4} km. How many times around the Earth, at the equator, would be the same as the distance to the Moon?

Grade 9
Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize, design and justify mathematical procedures, using appropriate patterns, models and technology.	1. Use logic and divergent thinking to present mathematical arguments in solving problems. [C, PS, R]	1.1 This figure contains several "upright" triangles. Construct your own definition of an "upright" triangle. Using your definition, how many "upright" triangles are there in a similar figure with 10 rows?  1.2 Explain how you can determine the last two digits of 6^{1000}. 1.3 Explain how you can use the laws of exponents, and a calculator, to order the following powers from largest to smallest: 3^{666}, 4^{555}, 5^{444}, 6^{333}.
	2. Model situations that can be represented by first-degree expressions. [CN, PS]	2.1 Write an expression or equation to represent each situation. The cost to rent a VCR is a \$25 deposit, plus \$10 for each day. How much will it cost to rent a VCR for 4 days? For 10 days? For d days? Bruce bought some licorice. It cost \$3.75 for the first kilogram and \$3.25 for each additional kilogram. How much would he pay for 3 kg? 10 kg? m kg?
	3. Write equivalent forms of algebraic expressions, or equations, with rational coefficients. [C, CN, R]	3.1 Explain how $\frac{x}{2}+\frac{3}{5}=4$, $\frac{3x}{2}+\frac{9}{5}=12$ and $5x+6=40$ are related. 3.2 Which of the following expressions is equivalent to $\frac{x+3}{2}$? Justify your choice. $x+3\div 2$ $\quad$ $\frac{x}{2}+\frac{3}{2}$ $\quad$ $2(x+3)$ 3.3 Explain how $C=2\pi r$ and $r=\frac{C}{2\pi}$ are related. 3.4 Given that density is mass divided by volume, explain why volume is mass divided by density.

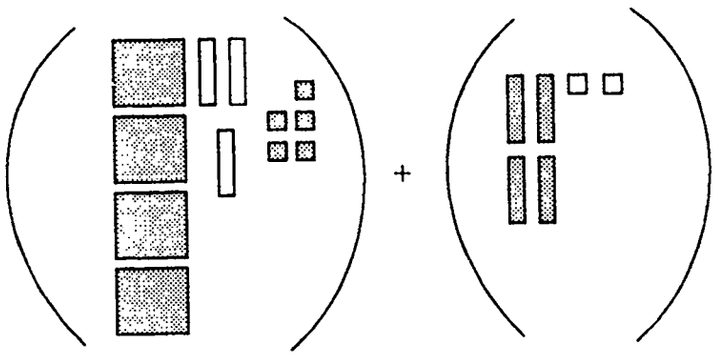
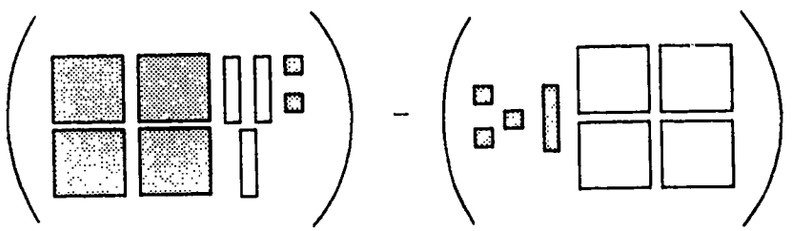
Grade 9
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Solve and verify linear equations and inequalities in one variable.	4. Illustrate the solution process for a first-degree, single-variable equation, using concrete materials or diagrams. [PS, R, V]	4–5.1 The equation $5x=4+3x$ has been modelled with algebra tiles. Explain how you can use the tiles to justify an algebraic solution process.  4–5.2 Use algebra tiles to justify an algebraic solution to $3x-7=-2x+8$ 
	5. Solve and verify first-degree, single-variable equations of forms, such as: • $ax=b+cx$ • $a(x+b)=c$ • $ax+b=cx+d$ • $a(bx+c)=d(ex+f)$ • $a/x=b$ where a, b, c, d, e and f are all rational numbers (with a focus on integers), and use equations of this type to model and solve problem situations. [C, PS, V]	5.1 A string measuring 50 cm in length is cut into three pieces. One piece is twice as long as the shortest piece and the other piece is 10 cm longer than the shortest piece. Find the length of each piece of string. 5.2 Dennis has \$25 and can save \$2.80 per day. Jeena has \$18 and can save \$3.70 per day. Who will be the first to be able to buy a \$72 tennis racquet? 5.3 Yutaka goes to the record store. Compact disks cost \$14 for the first one and \$13 for each additional one. If Yutaka buys M compact disks and spends D dollars, write an equation that represents the relationship between M and D. 5.4 Solve for x: $2(4x-5)=3(-2x+6)$ 5.5 C represents the number of compact disks and $C+C+4+2C=56$. Using this information, write a problem. 5.6 Explain the steps you would use to solve $\frac{12}{x}=6$ algebraically.

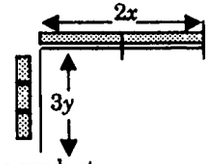
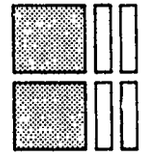
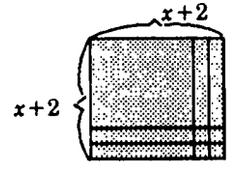
Grade 9
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Solve and verify linear equations and inequalities in one variable.	6. Solve, algebraically, first-degree inequalities in one variable, display the solutions on a number line and test the solutions. [PS, R, V]	6.1 Lillian received 77%, 69%, 81% and 76% on her mathematics tests. What mark does she need on her fifth test in order to achieve an arithmetic mean (average) of at least 80%? 6.2 Solve the following inequalities, and graph each solution on a number line. $x-5<12$ $-2x+3>10$ 6.3 Explain whether or not each of the following numbers $\{-3, +4, -7, +7\}$ is a solution to the inequality $2x-3>5$.
Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	7. Identify constant terms, coefficients and variables in polynomial expressions. [C]	7.1 What is the numerical coefficient of $-6a^4b$? 7.2 What is the constant term in the expression $4x-3=2y$?
	8. Evaluate polynomial expressions, given the value(s) of the variable(s). [E]	8.1 Evaluate the following expressions for the numbers given. $x^{-3}+y^3$ when $x=2$ and $y=-2$ $2x+6x^2-7$ when $x=-1$

Grade 9
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	9. Represent and justify the addition and subtraction of polynomial expressions, using concrete materials and diagrams. [C, R, V]	9.1 Explain how the algebra tiles given below can be used to justify an algebraic process for simplifying: $(4x^2-3x+5)+(4x-2)$. 
		9.2 Explain how the algebra tiles given below can be used to justify an algebraic process for simplifying: $(4x^2-3x+2)-(3+x-4x^2)$ 
	10. Perform the operations of addition and subtraction on polynomial expressions. [R]	

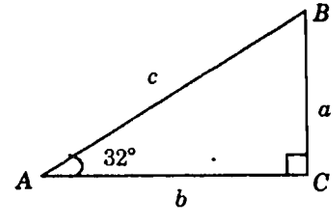
Grade 9
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	11. Represent multiplication, division and factoring of monomials, binomials, and trinomials of the form x^2+bx+c, using concrete materials and diagrams. [R, V]	11–12.1 Justin used algebra tiles and an area model to explain the multiplication $2x(3y)$. He set up the model by drawing a frame with dimensions $2x$ and $3y$.  Show how he filled the area model in to get the product. 11–12.2 Explain why the area model with algebra tiles can justify the product: $2x(x-2)$  11–12.3 Use an area model with algebra tiles to explain your algebraic solution to the product $(4x+1)(x+2)$. 11.1 Natalka modelled the process of factoring x^2+4x+4 by using algebra tiles and forming a square with them.  What are the factors of x^2+4x+4? Use Natalka's method to factor x^2+5x+6. Use algebra tiles to factor x^2-x-2.
	12. Find the product of two monomials, a monomial and a polynomial, and two binomials. [R]	12.1 Find the product of $-2x-3$ and $3x+4$.

Grade 9
Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

General Outcome	Specific Outcomes	Illustrative Examples
Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	13. Determine equivalent forms of algebraic expressions by identifying common factors and factoring trinomials of the form x^2+bx+c. [PS, R]	13.1 Simplify the following expressions by combining like terms, identifying any common factors and completing the factorization. $x^2+7x+10$ $3x^2+15x+18$ $6x^2-3x+x^2-18x+7$ $5x^2-11x+3x^2+32-29x$
	14. Find the quotient when a polynomial is divided by a monomial. [R]	14.1 Find the quotient: $\frac{12x^3-16x^2+8x}{4x}$.

Grade 9
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Use trigonometric ratios to solve problems involving a right triangle.	1. Explain the meaning of sine, cosine and tangent ratios in right triangles. [C]	1.1 The calculator shows the sine of 32° is equal to 0.5299. This implies that for ΔABC: $a = 0.5299$ and $c = 1.000$ $a = 5299$ and $c = 10\,000$ the length of a is 0.5299 of the length of c the length of c is 1.887 of the length of a. Explain why each of above statements is true. 
	2. Demonstrate the use of trigonometric ratios (sine, cosine and tangent) in solving right triangles. [PS]	2–4.1 A 10-m ladder is leaning against a building. The angle between the ladder and the ground is 40°. The base of the ladder is 1.5 m from the building. How far is the top of the ladder from the ground?
	3. Calculate an unknown side or an unknown angle in a right triangle, using appropriate technology. [PS, T]	2–4.2 Jenna walked across a rectangular school yard from one corner to the opposite corner. If the school yard is 40 m by 60 m, at what angle, with respect to the longer side, did she walk?
	4. Model and then solve given problem situations involving only one right triangle. [PS, T, V]	

Grade 9
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.	5. Relate expressions for volumes of pyramids to volumes of prisms, and volumes of cones to volumes of cylinders. [CN, R]	5.1 Carlos and Marie made nets and constructed a pyramid and a prism with identical heights and congruent triangular bases. They made similar pairs with congruent square bases. They estimated how much greater the volume of the prism was than the volume of the pyramid for each pair. Then they used sand to measure and compare their estimates. – Carry out their investigation, and find the relationship between the volume of a pyramid and the volume of a prism with the same base and height. – State this relationship in words. – Does the same relationship apply to cylinders and cones having identical heights and bases? – Explain, using models.
	6. Calculate and apply the rate of volume to surface area to solve design problems in three dimensions. [PS, T, V]	6.1 What is the maximum number of boxes measuring 6 cm × 3 cm × 2 cm that can be packed into a box measuring 24 cm by 8 cm by 11 cm? If each of the dimensions of the large packing box doubles, how many smaller boxes will fit? 6.2 Create a graph that illustrates height versus surface area for several cans with the same radii. Conduct a similar investigation to determine how the volumes of the cans are related. 6.3 Design three different containers that will hold 12 centimetre cubes and determine the most cost efficient container. 6.4 Dana and Akira made nets to construct cylinders. They both used the same rectangular piece, but Dana used the length to form the circumference of the cylinder and Akira used the width. Which cylinder will have the greatest surface area? Explain. Which cylinder will have the greatest volume? Explain. How would the results of this activity be useful to the canning industry?

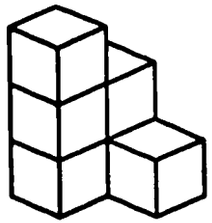
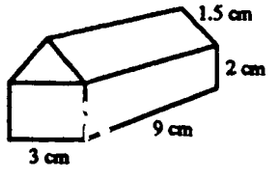
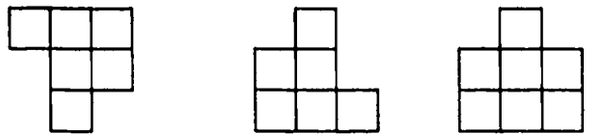
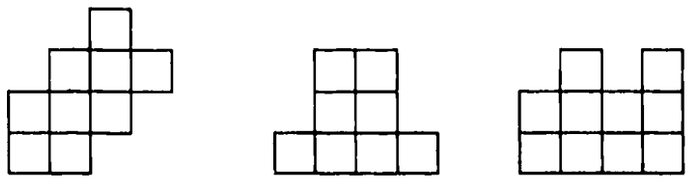
Grade 9
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

General Outcome	Specific Outcomes	Illustrative Examples
Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.	7. Calculate and apply the rate of area to perimeter to solve design problems in two dimensions. [PS, T, V]	6.5 Cereal is packed in boxes with a volume of 1000 cm^3. What dimensions should the cereal company choose for the boxes? Explain the reasons for your choice. 7.1 Barrie wanted to fence off a rectangular garden area. The fencing material comes in 1-m long units that cannot be cut. If Barrie has 12 m of fencing, what are the dimensions of the largest garden area he can make? Draw a diagram to explain your reasoning. 7.2 A store owner wants to make a rectangular area for a special display in one corner of his store. He has 6 m of enclosure rope to block off two sides of the area, using walls for the other 2 sides. What are the dimensions of the largest area he could rope off? 7.3 If you had a length of chicken wire that could bend anywhere, how could you find the largest area you could enclose without measuring? Explain, using different geometric shapes. If you had 16.25 m of the chicken wire, what would the dimensions be?

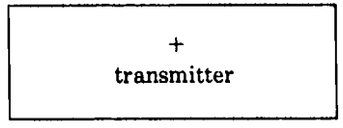
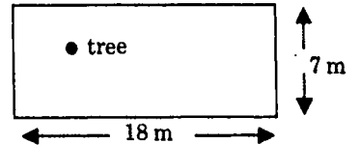
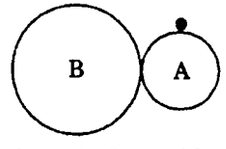
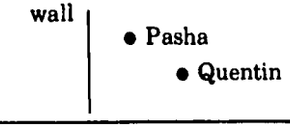
Grade 9
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Specify conditions under which triangles may be similar or congruent, and use these conditions to solve problems.	8. Recognize when, and explain why, two triangles are similar, and use the properties of similar triangles to solve problems. [C, PS, R, T]	8.1 Given one triangle, magnify two of the sides by a factor of 2. Explore the relationships between the angles and sides of the original triangle and the enlarged triangle. 8.2 A person 180 cm tall casts a shadow 45 cm long. A nearby telephone pole casts a shadow 300 cm long at the same time of day. What is the height of the pole? 8.3 Sol made a scale drawing of his rectangular vegetable garden, so he could plan how to plant it. Two sides of the garden are 10 m and 12 m and they form an angle of 50°. He drew a 50° angle on paper and made a triangle by marking off 20 cm and 24 cm on the sides of the angle and connecting them. He measured this side to be 19 cm. What is the length of the third side of this garden? 8.4 Shandra said that two triangles drawn on a page "looked" similar. How can she find out for sure if they are, or are not, similar? Find two different ways she can do this, and explain your reasoning.
	9. Recognize when, and explain why, two triangles are congruent, and use the properties of congruent triangles to solve problems. [C, CN, PS, R, T]	9.1 Heidi thought that two triangles looked congruent. To make sure, she cut them out and placed one on top of the other. - If she couldn't cut them out, how else could she be sure? - Find two different ways she could do this, and explain your reasoning.
	10. Relate congruence to similarity in the context of triangles. [CN, R]	10.1 Explain, giving examples, whether each of the following statements is true or false. - All similar triangles are congruent. - All congruent triangles are similar.

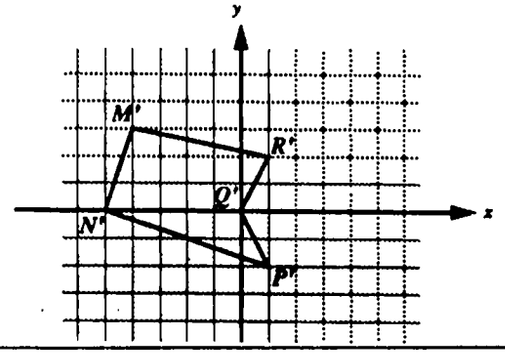
Grade 9
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use spatial problem solving in building, describing and analyzing geometric shapes.	11. Draw the plan and elevations of a 3-D object from sketches and models. [C, R, T,V]	11.1 Six cubes were used to build this model.  Using isometric dot paper, draw the overview plan, front elevation, and the left and right elevations.
		11.2 Draw and label the plan, front, right and left elevations of this sketch. 
	12. Sketch or build a 3-D object, given its plan and elevation views. [C, PS, T, V]	12.1 Build the object that follows the plan and the front and side views.  plan front side
		12.2 Use isometric dot paper to sketch the object illustrated by the following views.  overview plan front elevation side elevation

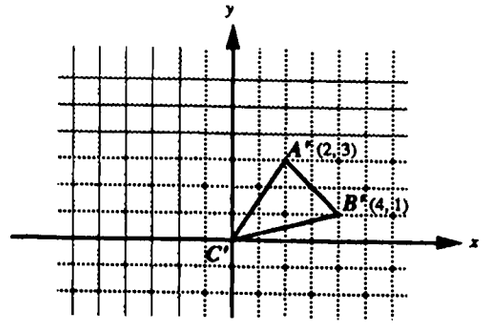
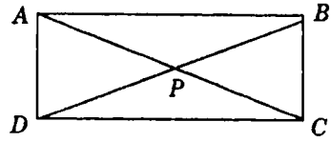
Grade 9
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

General Outcome	Specific Outcomes	Illustrative Examples
Use spatial problem solving in building, describing and analyzing geometric shapes.	13. Recognize and draw the locus of points in solving practical problems. [PS, T, V]	13.1 A radio transmitter can send out its programs a distance of 60 km or less. Choose a suitable scale, then mark some points that are 60 km or less. What does the area covered by the transmitter look like?  13.2 This is a plan of a backyard with a fence around it. The grass must be at least 1 m away from the tree and at least 2 m from the fence. Shade the area that will be grass.  13.3 A monkey can reach out 60 cm from the base of his cage. His cage is rectangular and measures 150 cm by 100 cm. Shade the part of the ground outside the cage where the monkey can reach. (The bars go all around the cage.) 13.4 Imagine a smaller circle (A) rolling around a larger circle (B).  What would the path of a specific point on circle A look like? Consider: – the centre of circle A – a point on the circumference of circle A. 13.5 Pasha and Quentin are hiding behind a high wall. Use diagrams to show: – points from which neither person can be seen – points from which Pasha but not Quentin can be seen – points from which both can be seen. 

Grade 9
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes.	14. Draw the image of a 2-D shape as a result of: • a single transformation • a dilatation • combinations of translations and/or reflections. [PS, T, V] 15. Identify the single transformation that connects a shape with its image. [R] 16. Demonstrate that a triangle and its dilatation image are similar. [R] 17. Demonstrate the congruence of a triangle with its: • translation image • rotation image • reflection image. [R]	14, 16 Draw a triangle with coordinates (2, 3), (4, 6) and (5, 4). Locate the dilatation image of the triangle with the dilatation centre at (0, 0) and a scale factor of 2. Explain how you know that the triangle and its image are similar. 14, 17 Draw a triangle with coordinates (3, 1), (6, 1) and (5, 3). Draw the resulting images for the following: – 90° clockwise rotation with rotation centre at (3, 1) – reflection with y-axis as line of reflection – translation—2 units right and 4 units down. Explain how each image is the same as the original figure and how it is different from the original figure. 14.1 Draw a triangle in the first quadrant. Identify the coordinates. – Perform a translation so that the image is completely in the fourth quadrant. Identify the coordinates of the image. – Perform a reflection of the above image so that its image is completely in the second quadrant. Identify the coordinates of this image. 14.2 This image M' (-4, 3), N' (-5, 0), P' (1, -2), Q' (0, 0), R' (1, 2) was obtained by subtracting 3 from each x-coordinate of the vertices M, N, P, Q and R. Draw the original figure. 

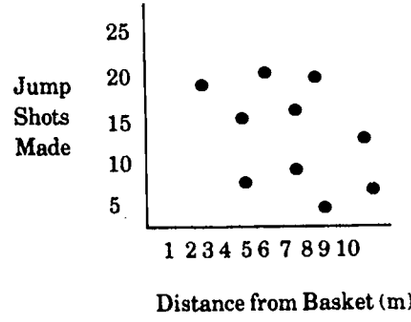
Grade 9
Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

General Outcome	Specific Outcomes	Illustrative Examples
Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes.		14.3 The triangle in the diagram was moved from its original position by adding 1 to its x-coordinates and 3 to its y-coordinates and then reflect over the x-axis. What was the original position of the triangle?  15.1 Rectangle $ABCD$ was transformed, and the image lies on top of $ABCD$.  What single rotation is required for a rotation about: – Point A? – Point P?

Grade 9
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect and analyze experimental results expressed in two variables, using technology, as required.	1. Design, conduct and report on an experiment to investigate a relationship between two variables. [C, CN, PS] 2. Create scatter plots for discrete and continuous variables. [C, V] 3. Interpret a scatter plot to determine if there is an apparent relationship. [E, R] 4. Determine the lines of best fit from a scatter plot for an apparent linear relationship by: • inspection • using technology (equations are not expected). [E, PS, T] 5. Draw and justify conclusions from the line of best fit. [C, R]	1–5.1 Design, conduct and report on an investigation into one of the following: – spring extension versus mass – mass versus volume for several samples of the same substance – price in Canadian dollars versus price in US dollars for books and magazines – temperature versus time of day over a two day period (nonlinear) – height versus "arm stretch"—distance between fingertips with arms fully extended – any other possible relationship you wish to investigate. 1–5.2 Create a scatter plot to investigate the relationship: – between the distance, in kilometres, that a student lives from school versus the time, in minutes, required to travel to school each morning – the number of cars in our school parking lot at 9:00 a.m. and the day of the week? Examine your scatter plot to: – describe the patterns of the dots – account for the dots that do not lie on the line – state a relationship in words for your plot. Use your ruler. Estimate and draw the line that best fits your dot pattern. Could your line be used to make predictions? Would any point that lies on the line have meaning with respect to the two variables? Explain.

Grade 9
Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

General Outcome	Specific Outcomes	Illustrative Examples
Collect and analyze experimental results expressed in two variables, using technology, as required.		5.1 – Draw the line of best fit. – What conclusions can be drawn from this data? – Describe the relationship between shots made and distance. 
	6. Assess the strengths, weaknesses and biases of samples and data collection methods. [C, R, T]	6–7 Collect data presented via newspaper, magazine, radio or TV. – How were samples for the data selected? Why do you think they were selected that way? Are they biased? – Were the data collection methods appropriate for the data and the issue? – How would you do it differently? Why? – Are the data presented clearly and honestly? – Do the conclusions follow logically from the data? – What questions are left unanswered? Is this deliberate?
	7. Critique ways in which statistical information and conclusions are presented by the media and other sources. [C, CN]	

Grade 9
Strand: Statistics and Probability (Chance and Uncertainty)
Students will:

- use experimental or theoretical probability to represent and solve problems involving uncertainty.

General Outcome	Specific Outcomes	Illustrative Examples
Explain the use of probability and statistics in the solution of complex problems.	8. Recognize that decisions based on probability may be a combination of theoretical calculations, experimental results and subjective judgements. [PS, R]	8.1 Interview some people to find out how they pick lottery numbers and why they choose particular numbers. 8.2 Jay checked data on how often each number has been drawn in a particular lottery. He chose six numbers that had been drawn the least often. Do they have a greater probability of being drawn the next time? Explain. 8.3 The weather forecast indicates that the probability of precipitation for tomorrow is 60%. Sasha will decide whether or not to go golfing, based on what criteria?
	9. Demonstrate an understanding of the role of probability and statistics in society. [C, CN]	9.1 Find examples from newspapers, radio, TV or other sources that use probability; e.g., marketing of products and services, weather forecasting, opinion polls. Are the data valid? Are they presented in an honest or in a misleading way? What assumptions are made?
	10. Solve problems involving the probability of independent events. [PS, T]	10.1 If you toss three pennies, what is the probability that they will all land heads? What other events are possible? Are all the events equally likely? Explain. What is the probability of getting two heads and one tail? Justify your answer by using pennies to illustrate all possible outcomes. 10.2 Amenu chose three, single digits for her combination lock. What is the probability that someone could make a lucky guess and open her lock? Explain. How could you set up a simulation experiment, using the computer to solve this problem? 10.3 There are two candies each of red, green and blue in a bag. What is the probability of drawing a red one? How many will you have to draw before you are sure of drawing a red one?

VII. APPENDICES

APPENDIX 1: SCOPE AND SEQUENCE CHART
[in development]

APPENDIX 2: REFERENCES

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APPENDIX 3: GLOSSARY
[in development]